THE ONTARIO ASSESSMENT INSTRUMENT POOL

MATHEMATICS

INTERMEDIATE DIVISION
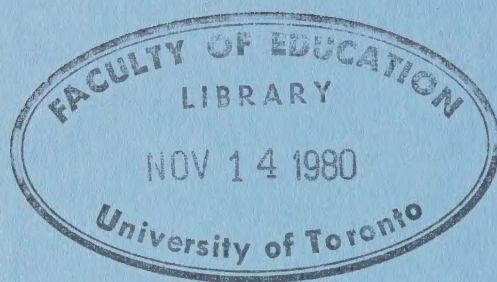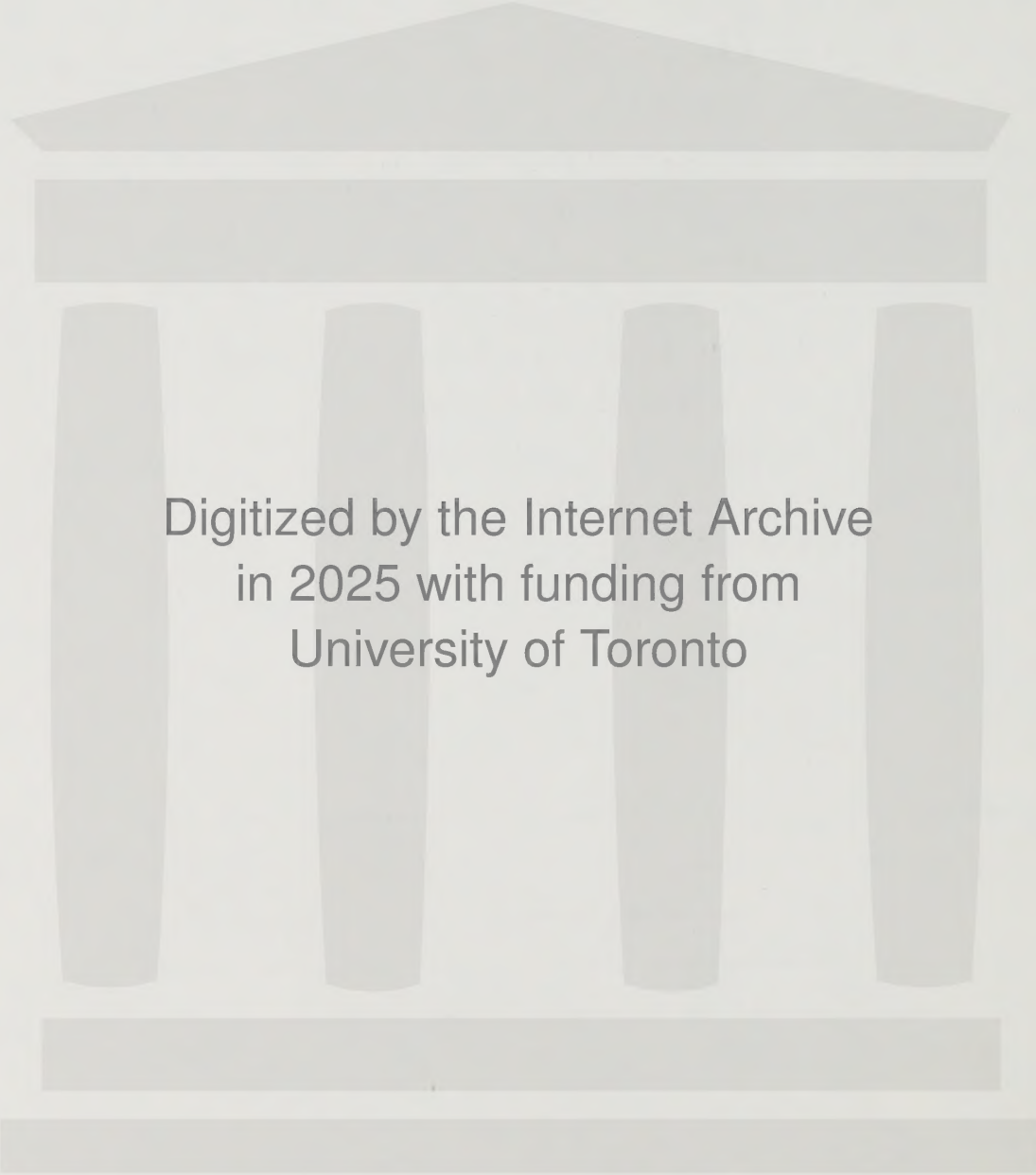
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MATHEMATICS
INTERMEDIATE DIVISION
ONTARIO ASSESSMENT INSTRUMENT POOL

This package contains assessment materials relating to the numerical methods, algebra, and measurement components of the Intermediate Division Mathematics Guideline, 1980. Additional materials will be distributed as they become available.

Cost: $15.00

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Table of Contents

OAIP
ASSESSMENT INSTRUMENTS FOR MATHEMATICS IN THE INTERMEDIATE DIVISION

Introduction

All the instruments in this document were developed by teachers working on a Ministry of Education funded project known as Computer Assisted Remediation and Evaluation (CARE). As the name implies, the intention was to select those topics which cause students the most difficulty in mathematics and prepare computer assisted instructional (CAI) sequences of a remedial nature. Included in these sequences were assessment instruments to diagnose specific problems and to measure individual students' achievement on stated objectives. The use of the computer facilitated the creation of an almost infinite number of assessment instruments that have been field tested by more than 5000 students in twenty schools across Ontario.

The writing teams of teachers were responsible for organizing the topics into objectives bound by a hierarchy of skill dependencies and for developing instruments with accompanying CAI sequences for each objective. A typical example is the addition of whole numbers, a topic that appears as N001000 under "Numerical Methods." The topic consists of 7 objectives; six of these (N001100-N001600) called enabling objectives relate to less complex skills and one (N001700) called a terminal objective encompasses all of the skills needed for adding whole numbers.

    N001100   Adding two one-digit numbers
    N001200   Adding five one-digit numbers
    N001300   Adding two two-digit numbers (no
                regrouping)

N001400   Adding two two-digit numbers (with
           regrouping)
N001500   Adding five two-digit numbers
N001600   Adding two numbers of up to four digits
N001700   Adding four numbers of up to four digits

By using an instrument form with specified parameters
(e.g., a + b + c + d, where a, b, c, and d are between 0 and
9999), it is possible to generate any number of instruments
without having them stored either in a computer or on paper.
This pool provides the instrument form for each objective
listed, and three examples of instruments that can be
generated from it. Teachers are encouraged to use the space
available on each page to record other examples.

The instruments in this pool cover approximately 35 per
cent of the curriculum described in the guideline
for intermediate mathematics and include nearly all the
topics listed under "Numerical Methods." The content areas
are:

-    Arithmetic (Whole Numbers, Fractions and
     Per cent, Integers and Rationals,
     Applications)   : 29 topics
-    Algebra (Basic Algebra, Equations): 12 topics
-    Measurement   : 7 topics
-    Probability   : 7 topics

Writing teams are currently developing instruments for use
with topics on Statistics and Geometry. As soon as they
have been reviewed and pilot tested, and relevant data have
been collected on each instrument, they will be published as
a supplement to this document.

While the computer has provided great assistance in the development of this pool of instruments, it has also imposed some restrictions on the variety of the work produced. Until quite recently, terminals were not suitable for developing instruments in Geometry. It is also difficult and time-consuming to print fractions in the vertical format (e.g., $\frac{2}{5}$. As a result, fractions almost always appear in a single line (e.g., 2/5). Teachers participating in the field trials did not report any difficulty in having students adjust to the single-line format.

Most of the instruments are judged to be of level 1, 2, or 3 (knowledge, comprehension, application) in terms of Bloom's taxonomy of cognitive functioning. Approximately 5 per cent of the instruments use a multiple-choice format, with the remainder being completion-type single-answer questions. While this instrument pool does not have, at this time, the variety and depth needed if it were to be used as the sole resource for collecting data on programs or students, it is hoped that it will support the assessment activities already in place by providing some instruments keyed to guideline objectives, together with tentative statistical data obtained from Ontario students indicating the relative difficulty of the instruments.

How Do I Find the Instruments I Want?

   The instruments have been organized to correspond with the titles used in the curriculum guideline Mathematics for the Intermediate Division. A coding system has been developed that relates each instrument to a particular objective of the guideline. For example, if you are interested in per cent, the table of contents lists two sections that contain relevant material, N018000 and N019000. The N indicates the general area Numerical Methods; 018 refers to expressing per cent in different ways and 019 to working with per cent. The fourth digit in the code identifies the objectives for the topic; e.g., N018100 through N018300 identify the enabling objectives and N018400 specifies the terminal objective for the topic expressing per cent in different ways. The instruments for each objective are numbered sequentially using the last two columns of the code,
e.g., N 0 1 8 4 0 3

                    Instrument: the third instrument

                    for this objective

                 Objective: Renaming per cents, ratios

                 and decimals

              Topic: Per cent expressed in different

              ways

         Numerical Methods

Similarly, A005301 identifies the first instrument for the objective solving inequalities in the strand labelled Algebra.

Following the terminal objective in each of the 29 topics listed under Numerical Methods is a set of ten instruments, under the heading Performance Analysis, which were randomly generated by the computer and pilot tested. These sets of instruments provide data on response time, difficulty level, and discrimination capability. Response time is a measure of how long students took to reply to the stimulus and it can serve as a guide in estimating the time needed for students to complete a test using these instruments. Difficulty levels (P-values) were calculated in the standard way - percentage of students giving the correct response; the lower the P-value, the more difficult the item. Discrimination capability indicates how well the item discriminated between the lower and higher ability students who answered the item; the higher the value, the more discriminating the item. It should be noted that these statistics are preliminary and should be used with caution.

How Do I Use the Instrument Models and Examples?

Once the specific type of instrument is located, you could either use the given examples or generate other assessment instruments using the instrument form. For example, in subtracting rationals (fraction form), instruments N026201, N026202, and N026203 are available. Should these be insufficient or unsuitable you could write new instruments as specified by the model:

a/b - c/d = ?

$-5 \leq a,c \leq 5$ $a,c \neq 0$

$-6 \leq b,d \leq 6$ $b,d \neq -1,0,1$

$a < b, c < d$

$b \neq d.$

Some of the instrument models are quite complicated because they are designed to generate instruments within a common range of difficulty.

An Example of How This Document Can Be Used

Assume that assessment instruments on multiplying fractions are wanted.

(a) Scan the table of contents. Section N012000 lists the enabling objectives and the terminal objective for this topic.

(b) Turn to the page listed. Here you will find references identifying the location of this topic in the mathematics guideline and providing statistics on instruments related to the target skill of the topic - multiplying two mixed numbers. If this objective (N012600) is what you wish to assess, then the instrument model and instruments N012601, N012602 and N012603 are appropriate. Because N012600 is the last objective in this topic, ten extra examples with statistics are provided under the heading Performance Analysis.

(c) If the instruments associated with objective N012600 appear too difficult or are inappropriate for any reason, another instrument model and its examples may be selected. Suppose simple "multiplying two fractions" more closely approximates the skill you wish to test. In this case, you could use any of the instruments N012301, N012302, and N012303, or you could generate other instruments according to the model given for objective N012300:

a/b x c/d = ?   (in lowest terms)

$1 \leq a, c \leq 6$

$2 \leq b, d \leq 9$

a is not a multiple of b

c is not a multiple of d

The number of possible instruments that can be created from this model exceeds 500. Some examples are:

1/3 x 2/7 = ?

2/5 x 3/4 = ?

5/8 x 6/5 = ?

Etc.

How to Share in Developing Additional Materials

The instruments in this document and those that remain to be published represent the efforts of knowledgeable and dedicated educators. However, there is a limit to what can be accomplished in a short span of time. For this reason, the collection of instruments published here should be viewed as the first stage in an on-going cooperative effort to develop a comprehensive pool of assessment materials for mathematics. Teachers using them can help further that development by:

(1) identifying omissions or weaknesses in this current version and providing suggestions for improvement;

(2) suggesting modifications either to the instruments or to the organization of the materials so that they could be more easily used in the assessment process;

(3) reporting on alternative applications of this pool of
    instruments.

    Comments, suggestions and examples should be forwarded
to:

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Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N001000: Addition of Whole Numbers

(a) Reference(s) to the Curriculum Guideline:
     Grade 7   N 2b
     Grade 8   N 1a
     Grade 9   Adv   N 1a
               Gen   N 1a
               Basic N 2b
               Mod   N 2b (Courses A,B)
     Grade 10 Gen   N 1a
               Mod   N 2b (Courses B,C)

(b) Difficulty Level:
     pre-instruction = .84, post-instruction = .90

     Grade 7   .81   .89
     Grade 8   .81   .90
     Grade 9   .85   .94
     Grade 10   .86   .92

OBJECTIVE N001100: Adding two one-digit numbers

MODEL: a + b = ?

           where $5 \le a \le 9$
                 $1 \le b \le 9$

EXAMPLES:

           N001101   8 + 3 = ? 11

           N001102   7 + 6 = ? 13

           N001103   2 + 5 = ? 7

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Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N001000: Addition of Whole Numbers

OBJECTIVE N001200: Adding five one-digit numbers.

MODEL: a
             b
             c
             d
             e
             —
             ? $1 \leq a,b,c,d,e \leq 9$

EXAMPLES:

N001201   5   N001202   3   N001203   5
           3   8   1
           1   7   7
           2   6   4
           3   2   9
           —   —   —
           ? 14   ? 26   ? 26

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N001000: Addition of Whole Numbers

OBJECTIVE: N001300: Adding two two-digit numbers
         (no regrouping)

MODEL: ab $1 \leq a,c \leq 9$
          +cd $0 \leq b,d \leq 9$
          ?

EXAMPLES:

            N001301   22   N001302   23   N001303   50
                       +57   +24   +47
                       ? 79   ? 47   ? 97

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N001000: Addition of Whole Numbers

OBJECTIVE N001400: Adding two two-digit numbers
(with regrouping)

MODEL: ab + cd = ?

$1 \leq a,b,c,d \leq 9$ and $b + d \geq 10$

EXAMPLES:

       N001401   69 + 82 = ?   151
       N001402   79 + 27 = ?   106
       N001403   17 + 93 = ?   110

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N001000: Addition of Whole Numbers

OBJECTIVE N001500: Adding five two-digit numbers

MODEL: ab + cd + ef + gh + ij = ?

$1 \leq a,c,e,g,i \leq 9$

$0 \leq b,d,f,h,j \leq 9$ $b + d + f + h + j \geq 10$

EXAMPLES:

          N001501   74 + 65 + 62 + 82 + 79   = ?   362
          N001502   14 + 56 + 64 + 93 + 24   = ?   251
          N001503   63 + 16 + 27 + 15 + 43   = ?   164

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N001000: Addition of Whole Numbers

OBJECTIVE N001600: Adding two numbers of up to four digits

MODEL: a + b = ?
          $10 \leq a,b \leq 9999$ and a and b do not have
                    the same number of digits

EXAMPLES:

          N001601   5342 + 193 = ?   5 535
          N001602   3547 + 63 = ?   3 610
          N001603   442 + 9853 = ? 10 295

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N001000: Addition of Whole Numbers

OBJECTIVE N001700: Adding four numbers of up to four digits

MODEL: $a + b + c + d = ?$
           $1 \leq a,b,c,d \leq 9999$

EXAMPLES:

N001701	211 + 9671 + 6131 + 9748	= ?	25 761
N001702	3 + 2112 + 29 + 8371	= ?	10 515
N001703	1 + 6257 + 80 + 2020	= ?	8 358

Ontario Assessment Instrument Pool

N001800 Performance Analysis (Instrument Statistics[1]) for Addition of Whole Numbers

Instrument					Calibration Sample Size	Average Student Response Time (seconds) n=2476	P- Value	Discrimi- nation
N001801	5 + 829 + 89 + 6067	= ?	6 990	(225)	112	.88	.24
N001802	725 + 26 + 9 + 7	= ?	767	(85)	126	.90	.10
N001803	2805 + 2501 + 9765 + 6086	= ?	21 157	(655)	102	.85	.20
N001804	8 + 6982 + 43 + 2729	= ?	9 762	(524)	125	.87	.11
				(76)		.83	.15
N001805	802 + 36 + 9162 + 3	= ?	10 003	(354)	124	.84	.27
				(371)		.84	.28
N001806	5412 + 5663 + 5268 + 643	= ?	16 986	(231)	110	.88	.18
				(139)		.87	.14
N001807	6 + 2866 + 92 + 9571	= ?	12 535	(309)	129	.88	.20
N001808	438 + 2 + 1494 + 7	= ?	1 941	(42)	125	.88	.28
N001809	1755 + 2736 + 618 + 9084	= ?	14 193	(175)	113	.81	.20
N001810	9 + 1944 + 11 + 9164	= ?	11 128	(217)	137	.86	.26

[1]statistics are given for each item and for each occurrence of an item on different test versions.

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Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N002000: Subtraction of Whole Numbers

(a) Reference(s) to the Curriculum Guideline:
     Grade 7   N 2b
     Grade 8   N 1a
     Grade 9 Adv   N 1a
              Gen   N 1a
              Basic N 2b
              Mod   N 2c (Courses A,B)
     Grade 10 Gen   N 1a
              Mod   N 2b (Courses B,C)

(b) Difficulty Level:
     pre-instruction = .56, post-instruction = .73

     Grade 7   .67   .76
     Grade 8   .65   .62
     Grade 9   .54   .78
     Grade 10   .51   .80

OBJECTIVE N002100: Subtracting with numbers between
                    1 and 18

MODEL: a $1 \le a \le 18$
           -b $0 \le b \le 9$
            ? $0 \le a - b \le 9$

EXAMPLES:

        N002101   18   N002102   12   N002103   6
                   -9   -5   -4
                   ? 9   ? 7   ? 2

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N002000: Subtraction of Whole Numbers

OBJECTIVE N002200: Subtracting with two-digit numbers
                    (no decomposition)

MODEL: ab - cd = ?
           $1 \leq a,c \leq 9$
           $0 \leq b,d \leq 9$
              $a \geq c$
              $b \geq d$

EXAMPLES:

           N002201   97 - 45 = ?   52

           N002202   47 - 23 = ?   24

           N002203   98 - 35 = ?   63

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N002000: Subtraction of Whole Numbers

OBJECTIVE N002300:   Subtracting with two-digit numbers
                     (with decomposition)

MODEL: $ab - cd = ?$
           $1 \leq a,c \leq 9$
           $0 \leq b,d \leq 9$
             $a > c$
             $b < d$

EXAMPLES:

N002301	96-77 = ?	19
N002302	55-39 = ?	16
N002303	92-55 = ?	37

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N002000: Subtraction of Whole Numbers

OBJECTIVE N002400:   Subtracting a number from a number
                     ending with zero

MODEL: a − b = ?
           a = c x 10
           1 ≤ c ≤ 10
           1 ≤ b ≤ 99
             b < a

EXAMPLES:

           N002401   40 − 17 = ?   23
           N002402   60 − 47 = ?   13
           N002403   40 − 11 = ?   29

Mathematics for the Intermediate Division

TOPIC N002000: Subtraction of Whole Numbers

OBJECTIVE N002500:   Subtracting with numbers of up to
three digits

MODEL: a - b = ?
            $10 \leq a \leq 900$ a is a multiple of 10
             $1 \leq b \leq 199$ a > b

EXAMPLES:

            N002501   260 - 127 = ?   133

            N002502   710 - 554 = ?   156

            N002503   470 - 93 = ?   377

MODEL: a - b = ?   units digit of a is non-zero
            $10 \leq a \leq 99$ and less than units digit of b
            $1 \leq b \leq 199$
              a > b

EXAMPLES:

            N002504   857 - 119 = ?   738

            N002505   154 - 77 = ?   77

            N002506   682 - 335 = ?   347

MODEL: a - b = ?
            $10 \leq a \leq 999$ units digit of a is greater
            $1 \leq b \leq 80$ than units digit of b
              a > b

EXAMPLES:

            N002507   603 - 71 = ?   532

            N002508   469 - 17 = ?   452

            N002509   138 - 65 = ?   73

Ontario Assessment Instrument Pool

N002600 Performance Analysis (Instrument statistics[1]) for Subtraction of Whole Numbers

Instrument		Calibration Sample Size	Average Student Response Time (seconds) n=1314	P-Value	Discrimination
N002601	202 − 17 = ? 185	(76)	84	.85	.25
N002602	690 − 15 = ? 675	(139)	94	.96	.23
N002603	356 − 70 = ? 286	(42)	83	.93	.12
N002604	228 − 129 = ? 99	(524)	104	.94	.20
N002605	510 − 103 = ? 407	(225)	88	.85	.26
N002606	64 − 61 = ? 13	(354)	88	.96	.06
		(231)		.96	.11
N002607	703 − 15 = ? 688	(371)	76	.84	.21
N002608	160 − 46 = ? 114	(85)	93	.92	.10
		(309)		.90	.19
N002609	872 − 20 = ? 852	(217)	71	.94	.20
		(655)		.95	.14
N002610	161 − 16 = ? 145	(175)	87	.93	.10

[1]Statistics are given for each item and for each occurrence of an item on different test versions.

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N003000: Multiplication of Whole Numbers

(a) Reference(s) to the Curriculum Guideline:
     Grade 7   N 2b
     Grade 8   N 1a
     Grade 9   Adv   N 1a
               Gen   N 1a
               Basic N 2b
               Mod   N 2d (Courses A and B)
     Grade 10 Gen   N 1a

(b) Difficulty Level:
     pre-instruction = .71, post-instruction = .81

     Grade 7   .65   .73
     Grade 8   .66   .90
     Grade 9   .70   .84
     Grade 10   .78   .84

OBJECTIVE N003100: Multiplying two one-digit
                    numbers

MODEL: a x b = ?
          $0 \leq a,b \leq 9$

EXAMPLES:

          N003101   6 x 7 = ? 42

          N003102   7 x 8 = ? 56

          N003103   3 x 8 = ? 24

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N003000: Multiplication of Whole Numbers

OBJECTIVE N003200:   Multiplying a two-digit number
                     by a one-digit number (no regrouping)

MODEL: $a \times b = ?$ or $b \times a = ?$
            $a = 2$ or 3
            $b = 10c + d$
            $1 \leq c, d \leq 3$

EXAMPLES:

            N003201 $3 \times 33 = ?$ 99

            N003202 $2 \times 12 = ?$ 24

            N003203 $23 \times 2 = ?$ 46

MODEL: $a \times b = ?$ or $b \times a = ?$
            $a = 4$
            $b = 10c + d$
            $1 \leq c, d \leq 2$

EXAMPLES:

            N003204 $22 \times 4 = ?$ 88

            N003205 $4 \times 12 = ?$ 48

            N003206 $11 \times 4 = ?$ 44

MODEL: $a \times b = ?$ or $b \times a = ?$
            $a = 11$
            $5 \leq b \leq 9$

EXAMPLES:

            N003207 $11 \times 8 = ?$ 88

            N003208 $7 \times 11 = ?$ 77

            N003209 $5 \times 11 = ?$ 55

Mathematics for the Intermediate Division

TOPIC N003000: Multiplication of Whole Numbers

OBJECTIVE N003300:   Multiplying a two-digit number
by a one-digit number
(three-digit answer)

MODEL: a x b = ? or b x a = ?
$5 \leq a \leq 9$
$b = 10c + 1$
$2 \leq c \leq 9$

EXAMPLES:

N003301	5 x 91 = ?	455
N003302	71 x 9 = ?	639
N003303	6 x 61 = ?	366

Mathematics for the Intermediate Division

TOPIC N003000: Multiplication of Whole Numbers

OBJECTIVE N003400: Multiplying a two-digit number
by a one-digit number
(with regrouping)

MODEL: a x b = ? or b x a = ?
            $6 \leq a \leq 9$
            b = 10c + d
            $2 \leq c \leq 9$
            $3 \leq d \leq 9$

EXAMPLES:

            N003401   6 x 94 = ?   564

            N003402   72 x 8 = ?   576

            N003403   49 x 7 = ?   343

MODEL: a x b = ? or b x a = ?
            $3 \leq a \leq 5$
            b = 10c + d
            $1 \leq c \leq 4$
            $4 \leq d \leq 9$

EXAMPLES:

            N003404   18 x 3 = ?   54

            N003405   5 x 46 = ?   230

            N003406   4 x 39 = ?   156

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N003000: Multiplication of Whole Numbers

OBJECTIVE N003500: Multiplying two two-digit numbers

MODEL: a x b = ? or b x a = ?
            $12 \leq a,b \leq 99$
            but ab $\neq$ a multiple of 10

EXAMPLES:

N003501	55 x 89 = ?	4 895
N003502	61 x 56 = ?	3 416
N003503	92 x 94 = ?	8 648

Mathematics for the Intermediate Division

TOPIC N003000: Multiplication of Whole Numbers

OBJECTIVE N003600: Multiplying involving zero

MODEL: a x b = ? or b x a = ?
           $11 \le a \le 99$ but not a multiple of 10
           b = 10c
           $3 \le c \le 9$

EXAMPLES:

           N003601   70 x 71 = ?   4 970

           N003602   60 x 17 = ?   1 020

           N003603   43 x 80 = ?   3 440

MODEL: a x b = ? or b x a = ?
           $11 \le a \le 99$ but not a multiple of 10
           b = 0

EXAMPLES:

           N003604   46 x 0 = ?   0

           N003605   0 x 99 = ?   0

           N003606   28 x 0 = ?   0

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N003000: Multiplication of Whole Numbers

OBJECTIVE N003700: Multiplying numbers of up to
three digits

MODEL: a x b = ? or b x a = ?
a and b are three digit numbers
with no 0 digits

EXAMPLES:

        N003701   461 x 193 = ?   88 973

        N003702   652 x 719 = ?   468 788

        N003703   945 x 244 = ?   230 580

MODEL: a x b = ? or b x a = ?
a is a three-digit number with
no 0 digits
b is a two-digit number with
no 0 digits

EXAMPLES:

        N003704   23 x 954 = ?   21 942

        N003705   291 x 87 = ?   25 317

        N003706   39 x 786 = ?   30 654

MODEL: a x b = ? or b x a = ?
a = 10c
$2 \leq c \leq 50$
b = 100d + e
$1 \leq d,e \leq 9$

EXAMPLES:

        N003707   190 x 809 = ?   153 710

        N003708   70 x 904 = ?   63 280

        N003709   206 x 360 = ?   74 160

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Ontario Assessment Instrument Pool

N003800 Performance Analysis (Instrument Statistics[1]) for Multiplication of Whole Numbers

Instrument			Calibration Sample Size	Average Student Response Time (seconds) n=1314	P-Value	Discrimi-nation
N003801	143 x 565 = ?	80 795	(309)	126	.73	.30
			(371)		.71	.23
N003802	30 x 702 = ?	21 060	(225)	115	.88	.32
			(231)		.90	.35
N003803	999 x 69 = ?	68 931	(139)	89	.76	.15
N003804	155 x 929 = ?	143 995	(217)	121	.83	.25
			(524)		.78	.27
N003805	39 x 836 = ?	32 604	(175)	125	.69	.27
			(85)		.67	.30
N003806	555 x 64 = ?	35 520	(354)	129	.84	.32
N003807	611 x 795 = ?	485 745	(42)	112	.67	.37
N003808	69 x 722 = ?	49 818	(76)	120	.70	.31
N003809	460 x 809 = ?	372 140	(655)	109	.64	.38

[1]Statistics are given for each item and for each occurrence of an item on different test versions.

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N004000: Division of Whole Numbers

(a) Reference(s) to the Curriculum Guideline:
     Grade 7   N 2b
     Grade 8   N 1a
     Grade 9 Adv   N 1a
              Gen   N 1a
              Basic N 2b
              Mod   N 2f   (Courses A,B)
     Grade 10 Gen   N 1a

(b) Difficulty Level:
     pre-instruction = .56, post-instruction = .73

     Grade 7   .67   .76
     Grade 8   .65   .62
     Grade 9   .54   .78
     Grade 10   .51   .80

OBJECTIVE N004100: Three algorithms for division

MODEL: Write a divided by b in fraction form

EXAMPLES:

     N004101   Write 5327 divided by 80 in fraction form
                5327/80

     N004102   Write 278 divided by 43 in fraction form
                278/43

     N004103   Write 71 302 divided by 4 in fraction form
                71 302/4

MODEL: Write $6\overline{)a}$ in fraction form
                 $10 \leq a \leq 999$
                  $2 \leq b \leq 99$
                   $a > b$

EXAMPLES:

     N004104   Write $93\overline{)403}$ in fraction form 403/93

     N004105   Write $12\overline{)738}$ in fraction form 738/12

     N004106   Write $77\overline{)600}$ in fraction form 600/77

Mathematics for the Intermediate Division

TOPIC N004000: Division of Whole Numbers

OBJECTIVE N004200: Division by numbers from 2 to 12

MODEL: $b \overline{)a}$ = ? $2 \leq b \leq 12$
                                            $a = b \times c$ where $2 \leq c \leq 12$

EXAMPLES:

N004201	$8 \overline{)48}$	= ?	6
N004202	$12 \overline{)144}$	= ?	12
N004203	$7 \overline{)35}$	= ?	5

MODEL: a divided by b = ? $2 \leq b \leq 12$
                                            $a = b \times c$ where $2 \leq c \leq 12$

EXAMPLES:

N004204	20 divided by 10 = ?	2
N004205	84 divided by 7 = ?	12
N004206	24 divided by 4 = ?	6

MODEL: a/b = ? $2 \leq b \leq 12$
                                            $a = b \times c$ where $2 \leq c \leq 12$

EXAMPLES:

N004207	60/5 = ?	12
N004208	108/12 = ?	9
N004209	36/3 = ?	12

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N004000: Division of Whole Numbers

OBJECTIVE N004300:   Short division with no decomposition
                     and no remainder

MODEL: a/b = ? $2 \leq b \leq 4$
                                 when b = 2, a = wxy or wxyz
                                 where x,y,z $\in$ {0,2,4,6,8}
                                        w $\in$ {2,4,6,8}
                                 when b = 3, a = wxy or wxyz
                                 where x,y,z $\in$ {0,3,6,9}
                                        w $\in$ {3,6,9}
                                 when b = 4, a = wxy or wxyz
                                 where x,y,z $\in$ {0,4,8}
                                        w $\in$ {4,8}

EXAMPLES:

          N004301   4408/4 = ?   1 102
          N004302   696/3 = ?   232
          N004303   8026/2 = ?   4 013

MODEL: a divided by b is ? (use the same
                                  parameters as above)

EXAMPLES:

          N004304   8460 divided by 2 is ?   4 230
          N004305   309 divided by 3 is ?   103
          N004306   4408 divided by 4 is ?   1 102

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N004000: Division of Whole Numbers

OBJECTIVE N004400:   Short division with decomposition
and no remainder

MODEL: b)‾a‾ $2 \le b \le 12$
a is a 3 or 4 digit number and
a multiple of b

EXAMPLES:

N004401	6)‾3504‾ = ?	584
N004402	12)‾3948‾ = ?	329
N004403	9)‾1863‾ = ?	207

MODEL: a divided by b is ? $2 \le b \le 12$
a four-digit number
and a multiple of b

EXAMPLES:

N004404	8358 divided by 3 = ?	2 786
N004405	5928 divided by 8 = ?	741
N004406	9372 divided by 11 = ?	852

MODEL: a/b = ? $2 \le b \le 12$
a is a four-digit number
and a multiple of b

EXAMPLES:

N004407	3605/5 = ?	721
N004408	6777/9 = ?	753
N004409	1926/2 = ?	963

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Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N004000: Division of Whole Numbers

OBJECTIVE N004500:   Short division with decomposition
                     and a remainder

MODEL: a/b = ?   where b 3,5,7,11 and
                     a is a three-digit number, not
                     a multiple of b

EXAMPLES:

N004501	152/3 = ?	50 2/3
N004502	670/7 = ?	95 5/7
N004503	406/11 = ?	36 10/11

MODEL: a/b = ?   where b 2,4,8 and a is a
                     three-digit odd number.

EXAMPLES:

N004504	353/2 = ?	176 1/2
N004505	971/8 = ?	121 3/8
N004506	107/4 = ?	26 3/4

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N004000: Division of Whole Numbers

OBJECTIVE N004600: Long division

MODEL: $b \overline{)a} = ?$ $11 \le b \le 22$
                                       $2 \le m \le 20$
                                       $a = mb + 1$

EXAMPLES:

N004601	$18 \overline{)325}$ = ?	18 1/18
N004602	$12 \overline{)193}$ = ?	16 1/12
N004603	$21 \overline{)400}$ = ?	19 1/21

MODEL: $b \overline{)a} = ?$ where b is an odd number between
                                       11 and 33, m is an odd number
                                       between 3 and 19
                                       $a = mb + 2$

EXAMPLES:

N004604	$27 \overline{)299}$ = ?	11 2/27
N004605	$13 \overline{)223}$ = ?	17 2/13
N004606	$31 \overline{)901}$ = ?	29 2/31

MODEL: $b \overline{)a} = ?$ where b is a two-digit number between
                                       13 and 99 and $a = mb + d$

                                       where $10 < m < x$
                                                $x = int\ (999/b)$
                                                $d = 2^y$
                                                y is an integer
                                                $o < y < \dfrac{\log b}{\log 2}$

EXAMPLES:

N004607	$19 \overline{)384}$ = ?	20 4/19
N004608	$45 \overline{)1645}$ = ?	36 5/9
N004609	$72 \overline{)4350}$ = ?	60 5/12

Ontario Assessment Instrument Pool

N004700 Performance Analysis (Instrument Statistics[1]) for Division of Whole Numbers

Instrument		Calibration Sample Size	Average Student Response Time (Seconds) n=614	P-Value	Discrimi- nation
N004701	3049 ÷ 41 = ? 74 15/41	(371)	208	.66	.37
N004702	1127 ÷ 25 = ? 45 2/25	(655)	191	.69	.36
N004703	2329 ÷ 27 = ? 86 7/27	(42)	122	.38	.30
N004704	1623 ÷ 22 = ? 73 17/22	(217)	214	.66	.31
		(76)		.53	.41
N004705	1535 ÷ 31 = ? 49 16/31	(225)	184	.50	.33
		(231)		.65	.48
N004706	6007 ÷ 75 = ? 80 7/75	(524)	227	.51	.37
N004707	2105 ÷ 89 = ? 23 58/89	(354)	180	.54	.28
N004708	533 ÷ 31 = ? 17 6/31	(139)	211	.68	.22
N004709	4523 ÷ 19 = ? 238 1/19	(175)	186	.55	.44
N004710	721 ÷ 19 = ? 37 18/19	(85)	218	.58	.43
		(309)		.64	.37

[1]Statistics are given for each item and for each occurrence of an item on different test versions.

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N005000: Factoring

(a) Reference(s) to the Curriculum Guideline:
    Grade 7   N 5a
    Grade 8
    Grade 9 Mod   N 2e (Course A)
             Mod   N 2e (Course B)
    Grade 10

(b) Difficulty Level:
    pre-instruction = .16, post-instruction = .66

    Grade 7   .12   .67
    Grade 8   .15   .31
    Grade 9   .12   .47
    Grade 10   .22   .51

OBJECTIVE N005100:   Determining if one number is a factor
                     of another

MODEL: Which one of a_1, a_2 and a_3 is a factor of b?
            $b = na_1$ where $2 \leq n \leq 25$
            and $4 \leq a_1 \leq 20$ $a_2 = a_1 + 1$ if $a_1 + 1$ is
                                            not a factor of b, otherwise
                                            $a_2 = a_1 + 2$
                                            $a_3 = a_2 + 1$ if $a_2 + 1$ is not
                                            a factor of b, otherwise
                                            $a_3 = a_2 + 2$

EXAMPLES:

            N005101   Which one of 4,6,7 is a factor of 70 ? 7
            N005102   Which one of 15,16,17 is a factor of
                       150 ? 15
            N005103   Which one of 17, 18, 19 is a factor of
                       153 ? 17

OBJECTIVE N005100 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N005000: Factoring

MODEL: Is a a factor of b? (yes or no)

           $2 \leq a \leq 25$ and if (i) a is a factor of b then

                                     $b = na \quad 2 \leq n \leq 20$

                               (ii) a is not a factor of

                                     b then $b = a^2 \pm 2$, $a > 2$

EXAMPLES:

           N005104   Is 13 a factor of 182 ?   yes
           N005105   Is 6 a factor of 93   ?   no
           N005106   Is 21 a factor of 357 ?   yes

OBJECTIVE N005200: Listing all the factors of a given
                    number

MODEL: All the numbers listed are factors of b.   There
           may be one factor missing.   What is the missing
           factor?   (Write N if there is no missing factor)

EXAMPLES:

           N005201   1,2,41,82 are factors of 82.
                      What is the missing factor?   Write N if
                      there is no missing factor.   N
           N005202   1,2,3,6,9,12,18,36 are factors of 36.
                      What is the missing factor?   Write N if
                      there is no missing factor.   4
           N005203   1,3,13 are factors of 39.   What is the
                      missing factor?   Write N if there is no
                      missing factor.   39

MODEL: List all the factors of b

OBJECTIVE N005200 (cont'd)

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Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N005000: Factoring

EXAMPLES:

      N005204   List all the factors of 85.   1,5,17,85

      N005205   List all the factors of 412. 1,2,4,103,
                    206,412

      N005206   List all the factors of 2000. 1,2,4,5,8,
                    10,16,20,25,40,50,80,100,125,200,250,400,
                    500,1000,2000

MODEL: All the numbers listed but one are factors of b.
            Which number is not a factor of b?

EXAMPLES:

      N005207   1,2,3,4,5,6,10,15,30. Which number is
                    not a factor of 30?   4

      N005208   1,5,17,95. Which number is not a factor
                    of 95?   17

      N005209   1,7,17,34,119. Which number is not a
                    factor of 119?   34

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N005000: Factoring

OBJECTIVE N005300: Determining if a given number is prime
or composite

MODEL: Is n prime or composite?

EXAMPLES:

        N005301   Is 42 prime or composite?
                   Write P for prime or C for composite   C
        N005302   Is 157 prime or composite?
                   Write P for prime or C for composite   P
        N005303   Is 681 prime or composite?
                   Write P for prime or C for composite   C

MODEL: Which of these numbers is composite?

EXAMPLES:

        N005304   19,41,62,72,88. Which of these numbers
                   is composite? 62,72,88
        N005305   103,119,243,561,23. Which of these
                   numbers is composite?   119,243,561
        N005306   25,57,79,182,367. Which of these numbers
                   is composite? 25,57,182

MODEL: Write the prime numbers between n and n_1
            (maximum of 3) $10 \leq n, n_1 \leq 100$

OBJECTIVE N005300 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N005000: Factoring

EXAMPLES:

    N005307   Write the prime numbers between 50 and 54. 53

    N005308   Write the prime numbers between 61 and 79.   67,71,73

    N005309   Write the prime numbers between 12 and 20. 13,17,19

Mathematics for the Intermediate Division

TOPIC N005000: Factoring

OBJECTIVE N005400:   Factoring a number into prime factors

MODEL: n = ? $n = 2^x 3^y 5^z t$

where $0 \leq x,y,z \leq 3$ and $x + y + z \leq 7$
and $t \epsilon \{1,7,11\}$ where $t = 1$ is
chosen 3 out of 4 times
$30 \leq n \leq 1000$ and $n \neq 7$ or 11

EXAMPLES:

N005401	200 = ?	2 x 2 x 2 x 5 x 5
N005402	40 = ?	2 x 2 x 2 x 5
N005403	375 = ?	3 x 5 x 5 x 5

Ontario Assessment Instrument Pool

N005500   Performance Analysis (Item Statistics[1]) for Factoring

Instrument	Express as a product of prime factors:	Calibration Sample Size	P-Value	Discrimination
N005501	60 = ? 5 x 3 x 2 x 2	(217)	.38	.46
N005502	120 = ? 5 x 3 x 2 x 2 x 2	(42)	.24	.44
N005503	30 = ? 2 x 3 x 5	(85)	.47	.46
N005504	100 = ? 5 x 5 x 2 x 2	(76)	.02	.02
N005505	250 = ? 5 x 5 x 5 x 2	(524)	.25	.50
		(139)	.33	.33
N005506	135 = ? 5 x 3 x 3 x 3	(225)	.14	.62
		(231)	.28	.57
N005507	200 = ? 5 x 5 x 2 x 2 x 2	(655)	.19	.46
N005508	675 = ? 5 x 5 x 3 x 3 x 3	(175)	.16	.33
		(354)	.15	.35
N005509	45 = ? 3 x 3 x 5	(309)	.28	.46
		(371)	.24	.55

[1]Statistics are given for each item and for each occurrence of an item on different test versions.

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Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N006000: Roots of Perfect Squares

(a) Reference(s) to the Curriculum Guideline:
     Grade 7
     Grade 8   N 1e
     Grade 9 Basic N 7a
             Mod   N 2e (Course B)
     Grade 10

(b) Difficulty Level:
     pre-instruction = .49, post-instruction = .81

     Grade 7   .20   .67
     Grade 8   .40   .67
     Grade 9   .47   .84
     Grade 10   .67   .94

OBJECTIVE N006100:   Finding roots of perfect squares by
                     inspection

MODEL: The square root of (a) = ?
            a is a perfect square $0 \leq a \leq 256$

EXAMPLES:

            N006101   The square root of 169 = ?   13

            N006102   The square root of 121 = ?   11

            N006103   The square root of 36 = ?   6

Mathematics for the Intermediate Division

TOPIC N006000: Roots of Perfect Squares

OBJECTIVE N006200:   Finding roots of perfect squares
using prime factors

MODEL: The square root of (a) = ?

a = bc $p \in \{2,3\}$, $q \in \{0,2,4\}$
b = p^q $p \in \{5,7\}$, $q \in \{0,2\}$
c is a perfect square
    $4 \leq c \leq 36$

EXAMPLES:

N006201	The square root of 1764 = ?	42
N006202	The square root of 900 = ?	30
N006203	The square root of 784 = ?	28

Ontario Assessment Instrument Pool

N006300 Performance Analysis (Instrument Statistics[1]) for Roots of Perfect Squares

Instrument	The Square Root of:	Calibration Sample Size	Average Student Response Time (Seconds) n=338	P-Value	Discrimination
N006301	$\sqrt{324}$ = ? 18	(139)	100	.68	.49
N006302	$\sqrt{64}$ = ? 8	(217)	132	.71	.60
		(42)		.81	.01
N006303	$\sqrt{900}$ = ? 30	(85)	67	.72	.49
N006304	$\sqrt{121}$ = ? 11	(217)	116	.60	.48
N006305	$\sqrt{100}$ = ? 10	(76)	105	.28	.38
N006306	$\sqrt{225}$ = ? 15	(354)	85	.59	.67
N006307	$\sqrt{1225}$ = ? 35	(655)	125	.33	.59
N006308	$\sqrt{144}$ = ? 12	(175)	198	.78	.32
		(309)		.67	.45
N006309	$\sqrt{9}$ = ? 3	(371)	75	.72	.45
N006310	$\sqrt{400}$ = ? 20	(231)	60	.62	.56
		(524)		.61	.63

[1]Statistics are given for each item and for each occurrence of an item on different test versions.

Mathematics for the Intermediate Division

TOPIC N007000: Exponents

(a) Reference(s) to the Curriculum Guideline:
Grade 7   N 5b
Grade 8   N 1b
Grade 9   Adv   N 3a
          Gen   N 3a
Grade 10 Gen   N 1e

(b) Difficulty Level:
pre-instruction = .28, post-instruction = .58

Grade		
Grade 7	.16	.59
Grade 8	.28	.28
Grade 9	.29	.63
Grade 10	.63	.34

OBJECTIVE N007100:   Exponents

MODEL: $a_1 \times a_2 \times \text{----} \ a_n = a^?$
What is the missing exponent?
$a \in \{1,2,3,10\}$ or $a \in \{4,5\}$ or $a \in \{6,7,8,9,11,12\}$
$1 \leq n \leq 5$ $1 \leq n \leq 3$ $n = 1$ or 2

EXAMPLES:

N007101	$17 \times 17 \times 17$	$= 17^?$	3
N007102	5×5	$= 5^?$	2
N007103	$1 \times 1 \times 1 \times 1 =$	$1^?$	4

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

OBJECTIVE N007200: Multiplication and division of powers
with the same base

MODEL: $a^b \times a^c = ?$ $2 \leq a \leq 99$
$2 \leq b, c \leq 50$

EXAMPLES:

N007201 $75^3 \times 75^{15} = ?$ 75^{18}
N007202 $42^{20} \times 42^4 = ?$ 42^{24}
N007203 $10^2 \times 10^{48} = ?$ 10^{50}

MODEL: $a^b / a^c = ?$ $2 \leq a \leq 99$
$2 \leq b \leq 50$
$1 \leq c \leq 49$
$b > c$

EXAMPLES:

N007204 $59^3 / 59^1 = ?$ 59^2
N007205 $61^{15} / 61^7 = ?$ 61^8
N007206 $5^{26} / 5^{19} = ?$ 5^7

Ontario Assessment Instrument Pool

N007300   Performance Analysis (Instrument Statistics[1]) for Exponents

Give your answer as a power

Instrument	Item		Calibration Sample Size	Average Student Response Time (seconds) n=292	P-Value	Discrimination
N007301	$2^8 \times 2^{15} = ?$	2^{23}	(217)	97	.31	.53
			(225)		.15	.26
N007302	$28^5 \times 28^4 = ?$	28^9	(655)	83	.26	.48
N007303	$57^2 \div 57^1 = ?$	57^1	(354)	135	.34	.47
			(371)		.39	.44
N007304	$98^{11} \times 98^6 = ?$	98^{17}	(42)	110	.26	.49
N007305	$65^{15} \div 65^{11} = ?$	65^4	(175)	101	.17	.21
N007306	$18^4 \times 18^{10} = ?$	18^{14}	(524)	97	.36	.56
N007307	$90^4 \div 90^3 = ?$	90^1	(76)	79	.08	.3
N007308	$84^{15} \times 84^2 = ?$	84^{17}	(231)	138	.42	.51
N007309	$94^2 \div 94^1 = ?$	94^1	(85)	98	.6	.52
			(309)		.41	.43
N007310	$87^3 \times 87^{11} = ?$	87^{14}	(139)	88	.5	.35

[1] statistics are given for each item and for each occurrence of an item on different test versions.

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N008000: Order of Operations

(a) Reference(s) to the Curriculum Guideline:
     Grade 7   N 2e
                        A 1a
     Grade 8   N 1a
     Grade 9   Adv   N 1a
               Gen   N 1a
               Basic   N 2b
     Grade 10 Gen   N 1a

(b) Difficulty Level:
     pre-instruction = .65, post-instruction = .81

     Grade 7   .79   .78
     Grade 8   .74   .65
     Grade 9   .58   .76
     Grade 10   .63   .93

OBJECTIVE N008100: Order of operations without brackets

MODEL: a/c + b x e = ?

           c x d - b   = ?

           b + a/c   = ?

                18 ≤ a ≤ 36   a is not prime

                 4 ≤ b ≤ 9

                 c is a factor of a, up to 6

                 4 ≤ d ≤ 16   d is not prime

                 e = 2 or 3

EXAMPLES:

           N008101   24/3 + 8 x 2 = ?   24
           N008102   4 x 10 - 5   = ?   35
           N008103   9 + 32/4   = ?   17

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Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N008000: Order of Operations

OBJECTIVE N008200: Order of operations

MODEL: (a - b) x (e + c) = ?
            e x (a - (b + c)) = ?
            (b + c^e) x e   = ?
                18 $\leq$ a $\leq$ 36   a is not prime
                 4 $\leq$ b $\leq$ 9
                 c is a factor of a, up to 6
                 4 $\leq$ b $\leq$ 16   d is not prime
                 e = 2 or 3

EXAMPLES:

            N008201   (20 - 8) x (2 + 2) = ?   48
            N008202   3 x (35 - (5 + 5)) = ?   75
            N008203   (8 + 6^2) x 2   = ?   88

N008300 Performance Analysis (Instrument Statistics[1]) for Order of Operations

Instrument		Calibration Sample Size	Average Student Response Time (Seconds) n=336	P-Value	Discrimination
N008301	$4 + [25 - (5 + 7)] \times 2$ = ? 30	(76)	76	.22	.3
N008302	$14 + [30 - (5 + 9)] \times 3$ = ? 62	(524)	112	.45	.44
N008303	$30 - (8 + 5)$ = ? 17	(85)	134	.91	.41
		(655)		.79	.42
N008304	$(32 - 6) \times (2 + 2)$ = ? 104	(217)	100	.82	.4
		(225)		.82	.19
N008305	$2 \times [25 - (9 + 5)]$ = ? 22	(354)	101	.71	.5
N008306	$(6 + 5^3) \times 3$ = ? 393	(309)	117	.34	.32
N008307	$(30 + 6) \div 6$ = ? 6	(42)	141	.98	.05
N008308	$14 + [34 - (2 + 6)] \times 3$ = ? 92	(231)	84	.43	.49
N008309	$18 - (7 + 6)$ = ? 5	(175)	131	.87	.19
		(371)		.84	.31
N008310	$(26 - 5) \times (3 + 2)$ = ? 105	(139)	92	.9	.09

[1] Statistics are given for each item and for each occurrence of an item on different test versions.

Mathematics for the Intermediate Division

TOPIC N009000: Addition and Subtraction of Decimals

(a) Reference(s) to the Curriculum Guideline:
      Grade 7   N 2b
      Grade 8   N 1a
      Grade 9 Adv   N 1a
               Gen   N 1a
               Basic N 2c
               Mod   N 3b   (Courses A,B,C)
      Grade 10 Gen   N 1a

(b) Difficulty Level:
     pre-instruction = .65 post-instruction = .87

      Grade 7   .51   .72
      Grade 8   .60   .78
      Grade 9   .63   .86
      Grade 10   .76   .87

OBJECTIVE N009100:   Adding and subtracting decimals
                     from 0.001 to 900

MODEL: $x + y + z = ?$
           Each x, y, z, is a number in the form a x b
           where $a \in \{1, 0.1, 0.01, 0.001\}$
                 $b \in \{1 - 9\}$ or $\{10 - 90\}$ or $\{100 - 900\}$
           The cases where all numbers are integers are exclu

EXAMPLES:

           N009101   0.8 + 8.95 + 62.7   = ?   72.45

           N009102   0.06 + 21.4 + 64.1 = ?   85.56

           N009103   8.56 + 900 + 23.4   = ?   931.96

MODEL: $x - y = ?$ $x > y$
           Each x,y is a number in the form a x b
           with the same parameters as above

EXAMPLES:

           N009104   791 - 8.3   = ?   782.7

           N009105   65.42 - 1.706 = ?   63.714

           N009106   240.04 - 39.4 = ?   200.64

Ontario Assessment Instrument Pool

N009200 Performance Analysis (Instrument Statistics[1]) for Addition and Subtraction of Decimals

Instrument			Calibration Sample Size	Average Student Response Time (Seconds) n=468	P-Value	Discrimination
N009201	0.008 + 0.18 + 0.004	= ? 0.192	(42)	77	.95	.02
N009202	321 + 0.4 + 0.3	= ? 321.7	(175)	57	.68	.45
N009203	89.9 − 0.41	= ? 89.49	(371)	60	.63	.54
N009204	6 + 0.086 + 0.3	= ? 6.386	(655)	60	.66	.53
N009205	69.9 − 33.8	= ? 36.1	(225)	79	.87	.36
N009206	286 + 0.6 + 428	= ? 714.6	(85)	64	.79	.54
			(524)		.76	.53
N009207	0.08 − 0.002	= ? 0.078	(217)	73	.63	.54
			(231)		.65	.57
N009208	89.2 + 23.6 + 5	= ? 117.8	(139)	90	.80	.47
N009209	28.1 − 0.061	= ? 28.039	(309)	76	.56	.51
			(354)		.48	.58
N009210	0.043 + 0.02 + 0.66	= ? 0.723	(76)	87	.70	.28

[1]Statistics are given for each item and for each occurrence of an item on different test versions.

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Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N010000: Multiplication of Decimals

(a) Reference(s) to the Curriculum Guideline:
```
    Grade 7         N 2b
    Grade 8         N 1a
    Grade 9  Adv    N 1a
             Gen    N 1a
             Basic  N 2c
             Mod    N 3c (Courses B,C)
    Grade 10 Gen    N 1a
```

(b) Difficulty Level:
pre-instruction = .59 post-instruction = .77

```
    Grade 7      .42                        .74
    Grade 8      .49                        .66
    Grade 9      .60                        .74
    Grade 10     .72                        .83
```

OBJECTIVE N010100: Multiplying with numbers between
                    0.01 and 900

MODEL: a.b x 0.cd = ?
           $1 \leq a,b,c \leq 9$

EXAMPLES:

```
        N010101    9.4 x 0.19      = ?   1.786
        N010102    8.7 x 0.68      = ?   5.916
        N010103    9.6 x 0.79      = ?   7.584
```

MODEL: a0 x 0.bc = ?
           $1 \leq a,b,c \leq 9$

EXAMPLES:

```
        N010104    50 x 0.21 = ?   10.5
        N010105    80 x 0.69 = ?   55.2
        N010106    90 x 0.87 = ?   78.3
```

OBJECTIVE N010100 Cont'd

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Mathematics for the Intermediate Division

MODEL: 0.0ab x c.d = ?
           $1 \leq a,b,c \leq 9$

EXAMPLES:

      N010107   0.098 x 8.8 = ?   0.8624

      N010108   0.065 x 7.3 = ?   0.4745

      N010109   0.074 x 9.6 = ?   0.7104

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N010000: Multiplication of Decimals

OBJECTIVE N010200: Multiplying by powers of 10

MODEL: p x n = ?

$1 \leq a,b,c,d \leq 9$

$1 \leq e \leq 5$

$f = a \times b \times 100 + c + d$

$p = 10^{(-e)} \times f$

$n = 10^{x}$

$1 \leq x \leq e + 1$

EXAMPLES:

N010201	0.608 x 1000	= ?	608
N010202	0.415 x 10	= ?	4.15
N010203	25.02 x 100	= ?	2502

Ontario Assessment Instrument Pool

N010300 Performance Analysis (Instrument Statistics[1]) for Multiplication of Decimals

Instrument		Calibration Sample Size	Average Student Response Time (Seconds) n=544	P-Value	Discrimination
N010301	9.1 x 0.84 = ? 7.644	(231)	73	.67	.41
N010302	0.085 x 8.1 = ? 0.6885	(139)	76	.71	.55
N010303	3.2 x 95 = ? 304	(76)	99	.63	.45
N010304	0.09 x 0.08 = ? 0.0072	(371)	66	.54	.55
		(354)		.50	.6
N010305	903 x 0.07 = ? 63.21	(275)	80	.66	.37
		(85)		.71	.49
N010306	5.8 x 0.86 = ? 4.988	(217)	75	.63	.44
N010307	0.053 x 0.041 = ? 0.002173	(42)	85	.57	.12
N010308	60 x 0.55 = ? 33	(524)	110	.77	.52
		(309)		.67	.47
N010309	0.069 x 1.4 = ? 0.0966	(225)	77	.52	.43
N010310	7.7 x 17 = ? 130.9	(655)	81	.59	.51

[1] Statistics are given for each item and for each occurrence of an item on different test versions.

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N011000: Division of Decimals

(a) Reference(s) to the Curriculum Guideline:
     Grade 7   N 2b
     Grade 8   N 1a
     Grade 9 Adv   N 1a
              Gen   N 1a
              Basic   N 2b
              Mod   N 3c (Courses A,B,C)
     Grade 10 Gen   N 1a

(b) Difficulty Level:
     pre-instruction = .32, post-instruction = .61

     Grade 7   .06   .40
     Grade 8   .19   .46
     Grade 9   .31   .56
     Grade 10   .50   .62

OBJECTIVE N011100: Dividing with whole number divisors
                    correct to two decimal places

MODEL: a/b = ? (correct to two decimal places)
           $6 \leq b \leq 25$
           $b < a \leq 50$

EXAMPLES:

           N011101   15/9 = ? (Correct to two decimal places)
                             1.67

           N011102   33/12 = ? (Correct to two decimal places)
                             2.75

           N011103   47/20 = ? (Correct to two decimal places)
                             2.35

MODEL: a/b = ?
           $2 \leq b \leq 25$
           $1 \leq a < b$

OBJECTIVE N011100 (cont'd)

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<u>Mathematics for the Intermediate Division</u>

EXAMPLES:

      N011104   2/7   = ? (Correct to two decimal places)
                       0.29

      N011105   15/23 = ? (Correct to two decimal places)
                       0.65

      N011106   3/11 = ? (Correct to two decimal places)
                       0.27

OBJECTIVE N011200: Dividing with decimal divisors

MODEL: a/b = ? (Correct to two decimal places)
           $5.0 \leq b \leq 9.9$ one decimal place
           $10.0 \leq a \leq 49.9$

EXAMPLES:

      N011201   31.2/6.6 = ? (Correct to two decimal
                           places) 4.73

      N011202   18.7/2.3 = ? (Correct to two decimal
                           places) 8.13

      N011203   43.9/9.8 = ? (Correct to two decimal
                           places) 4.48

MODEL: a/b = ? (Correct to two decimal places)
           $b = c \times 10^{d}$ $a = e \times 10^{f}$
           $51 \leq c \leq 89$ $200 \leq e \leq 500$
           $d = -2$ or -1 $f = -3$ or -2

OBJECTIVE N011200 (cont'd)

Mathematics for the Intermediate Division

EXAMPLES:

        N011204   0.254/5.6 = ? (Correct to two decimal places) 0.05

        N011205   0.4/0.6   = ? (Correct to two decimal places) 0.67

        N011206   0.126/3.7 = ? (Correct to two decimal places) 0.03

MODEL: a/b = ? (Correct to two decimal places)

$0.2 \le b \le 0.9$ one decimal place

$a = e \times 10^{f}$

$11 \le e \le 50$

$f = -2$ or -1

EXAMPLES:

        N011207   0.45/0.7 = ? (Correct to two decimal places) 0.64

        N011208   0.19/0.3 = ? (Correct to two decimal places) 0.63

        N011209   2.5/0.9   = ? (Correct to two decimal places) 2.78

Ontario Assessment Instrument Pool

N011300 Performance Analysis (Instrument Statistics[1]) for Division of Decimals

Instrument	Give your answer correct to TWO DECIMAL PLACES	Calibration Sample Size	Average Student Response Time (seconds) n=368	P-Value	Discrimination
N011301	2.4 ÷ 7.4 = ? 0.32	(175)	186	.2	.35
N011302	1.5 ÷ 0.5 = ? 3	(309)	103	.49	.43
N011303	0.403 ÷ 5.9 = ? 0.07	(371)	104	.27	.56
		(217)		.35	.66
		(76)		.07	.39
N011304	2.4 ÷ 0.6 = ? 4	(231)	175	.58	.47
		(524)		.61	.55
N011305	47.3 ÷ 7.8 = ? 6.06	(85)	45	.44	.53
N011306	4.98 ÷ 0.64 = ? 7.78	(354)	108	.34	.6
		(225)		.21	.5
N011307	3.7 ÷ 0.7 = ? 5.29	(42)	143	.10	.12
N011308	28.9 ÷ 8.8 = ? 3.28	(655)	63	.26	.58
N011309	0.299 ÷ 0.77 = ? 0.39	(139)	158	.27	.59

[1] Statistics are given for each item and for each occurrence of an item on different test versions.

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N012000: Multiplication of Fractions

(a)   Reference(s) to the Curriculum Guideline:
        Grade 7   N 3b
        Grade 8   N 2a
        Grade 9 Adv   N 4a
                 Gen   N 4a
                 Basic N 3e
                 Mod   N 6c (Courses A,B,C)
        Grade 10

(b)   Difficulty Level:
        pre-instruction = .44   post-instruction = .72

        Grade 7   .19   .50
        Grade 8   .36   .58
        Grade 9   .46   .67
        Grade 10   .59   .80

OBJECTIVE N012100:   Multiplying unit fractions by
                     natural numbers

MODEL: 1/a x b = ?
             $a \in \{2,4\}$
             $b \in \{4,8\}$

EXAMPLES:

             N012101   1/4 x 8 = ?   2

             N012102   1/2 x 8 = ?   4

             N012103   1/4 x 4 = ?   1

MODEL: 1/a x b = ?
             $a \in \{3,5,7,9\}$
             $b \in \{2,4,8\}$

OBJECTIVE N012100 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N012000: Multiplication of Fractions

EXAMPLES:

N012104	1/9 x 2 = ?	2/9
N012105	1/7 x 8 = ?	1 1/7
N012106	1/3 x 9 = ?	3

MODEL: 1/a x b = ?   a = 6 and b {5,7}

EXAMPLES:

N012107	1/6 x 5 = ?	5/6
N012108	1/6 x 7 = ?	7/6 or 1 1/6

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N012000: Multiplication of Fractions

OBJECTIVE N012200: Reducing fractions to lowest terms

MODEL: ax/bx reduced is ?
           $1 \leq a \leq 5$
           $2 \leq b \leq 7$
           $2 \leq x \leq 6$

EXAMPLES: Reduce to lowest terms:

           N012201   12/42 = ?   2/7

           N012202   6/15 = ?   2/5

           N012203   6/36 = ?   1/6

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N012000: Multiplication of Fractions

OBJECTIVE N012300: Multiplying two fractions

MODEL: a/b x c/d = ? (lowest terms)
           1 ≤ a,c ≤ 6   a is not a multiple of b
           2 ≤ b,d ≤ 9   c is not a multiple of d

EXAMPLES: Express the product in lowest terms:

           N012301   5/2 x 3/2 = ? 15/4 or 3 3/4
           N012302   1/8 x 1/3 = ? 1/24
           N012303   3/2 x 5/9 = ? 5/6

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N012000: Multiplication of Fractions

OBJECTIVE: N012400:   Changing mixed number to
                            fraction form

MODEL: c   a/b = ?   a/b in lowest terms
            $1 \leq c \leq 6$
            $1 \leq a \leq 5$
            $2 \leq b \leq 7$
             $a < b$

EXAMPLES: Change to fraction form

            N012401   4 1/2 = ?   9/2

            N012402   4 5/6 = ?   29/6

            N012403   2 3/5 = ?   13/5

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N012000: Multiplication of Fractions

OBJECTIVE N012500: Multiplying mixed numbers
                    by fractions

MODEL: c a/b x d/e = ?
            1 ≤ c ≤ 3
            1 ≤ a,d̄ ≤ 4
            2 ≤ b,e ≤ 5
              a < b
              d < e

EXAMPLES:

            N012501   1 1/3 x 1/5 = ?   4/15

            N012502   1 1/5 x 1/2 = ?   3/5

            N012503   3 2/3 x 1/4 = ?   11/12

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N012000: Multiplication of Fractions

OBJECTIVE N012600: Multiplying two mixed numbers

MODEL: c a/b x d e/f = ?
           1 ≤ c,d ≤ 3
           1 ≤ a,e ≤ 4
           2 ≤ b,f ≤ 5
           a < b and e < f

EXAMPLES:

           N012601   1 3/4 x 2 1/2 = ?   35/8   or 4 3/8
           N012602   1 1/5 x 2 3/4 = ?   33/10 or 3 3/10
           N012603   1 1/2 x 2 1/5 = ?   33/10 or 3 3/10

Ontario Assessment Instrument Pool

N012700   Performance Analysis (Instrument Statistics[1]) for Multiplying Fractions

Instrument	Item		Calibration Sample Size	Average Student Response Time (seconds) n=255	P-Value	Discrimination
N012701	3 1/2 x 2 4/5 = ?	9 4/5 or 49/5	(309)	152	.53	.52
N012702	1 1/2 x 1 1/3 = ?	2	(76)	75	.30	.49
N012703	1 1/3 x 3 1/2 = ?	14/3 or 4 2/3	(175)	85	.53	.46
N012704	2 1/2 x 1 2/3 = ?	4 1/6 or 25/6	(139)	82	.63	.32
N012705	3 4/5 x 1 1/2 = ?	5 7/10 or 57/10	(524)	92	.64	.53
			(655)		.33	.62
N012706	3 1/2 x 1 3/5 = ?	5 3/5 or 28/5	(85)	80	.56	.49
			(225)		.36	.5
N012707	3 1/5 x 1 1/2 = ?	24/5 or 4 4/5	(354)	78	.59	.56
			(371)		.56	.6
N012708	1 1/2 x 2 1/6 = ?	3 1/4 or 13/4	(217)	104	.59	.53
N012709	3 2/3 x 3 4/5 = ?	209/15 or 13 14/15	(42)	86	.07	.49
N012710	2 4/5 x 3 2/3 = ?	10 4/15 or 154/15	(231)	137	.52	.57

[1]Statistics are given for each item and for each occurrence of an item on different test versions.

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Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N013000: Division of Fractions

(a) Reference(s) to the Curriculum Guideline:
        Grade 7   N 3b
        Grade 8   N 2a
        Grade 9   Adv   N 4a
                  Gen   N 4a
                  Basic N 3e
        Grade 10

(b) Difficulty Level:
     pre-instruction = .45   post-instruction = .77

        Grade 7   .19   .45
        Grade 8   .32   .71
        Grade 9   .45   .77
        Grade 10   .64   .87

OBJECTIVE N013100: Dividing a mixed number by a
                    natural number

MODEL: (a b/c)/d = ?   (lowest terms)
           1 ≤ a ≤ 3   b < c
           1 ≤ b ≤ 4   b/c   written in lowest terms
           2 ≤ c,d ≤ 6

EXAMPLES:

           N013101   (3 1/2)/2 = ?   7/4 or 1 3/4

           N013102   (1 4/5)/6 = ?   3/10

           N013103   (2 1/6)/3 = ?   13/18

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N013000: Division of Fractions

OBJECTIVE N013200: Dividing a mixed number by a
fraction

MODEL: (a b/c)/ (d/e) = ?   (lowest terms)
           1 $\leq$ a $\leq$ 3   b < c
           1 $\leq$ b,$\overline{d}$ $\leq$ 4   d < e
           2 $\leq$ c,e $\leq$ 6   b/c and d/e are in lowest terms

EXAMPLES:

        N013201   (1 3/4)/(2/3) = ?   21/8 or 2 5/8

        N013202   (3 4/5)/(1/6) = ?   114/5 or 22 4/5

        N013203   (2 1/3)/(4/5) = ?   35/12 or 2 11/12

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N013000:   Division of Fractions

OBJECTIVE N013300:   Dividing a mixed number by a
mixed number

MODEL: (a b/c)/d(d e/f) = ? (lowest terms)
$1 \leq a,d \leq 3$ b < c
$1 \leq b,e \leq 4$ e < f
$2 \leq c,f \leq 6$ b/c and e/f are in lowest terms

EXAMPLES:

        N013301   (3 1/5)/(1 3/5) = ?   2

        N013302   (1 1/2)/(3 2/3) = ?   9/22

        N013303   (2 4/5)/(2 1/6) = ?   1 19/65

Ontario Assessment Instrument Pool

N013400   Performance Analysis (Instrument Statistics[1]) for Dividing Fractions

Instrument	Item	Calibration Sample Size	Average Student Response Time (seconds) n=255	P-Value	Discrimination
N013201	1 1/2 ÷ 1/4 = ? 6	(655)	29	.4	.65
N013202	1 1/3 ÷ 4 = ? 1/3	(42)	39	.17	.62
N013203	(1 2/3) ÷ (2/3) = ? 5/2 or 2 1/2	(371)	45	.50	.61
N013204	4/7 ÷ 2/7 = ? 2	(225)	38	.56	.47
		(231)		.76	.53
N013205	(1 2/3) ÷ (2 1/3)= ? 5/7	(354)	43	.53	.58
N013206	(2 2/3) ÷ 5 = ? 8/15	(175)	88	.44	.5
		(85)		.51	.57
N013207	3 1/2 ÷ 3/4 = ? 4 2/3 or 14/3	(139)	64	.72	.47
N013208	3/5 ÷ 1/6 = ? 18/5 or 3 3/5	(217)	91	.7	.61
		(524)		.67	.58
N013209	(3 1/6) ÷ (3 2/3) = ? 19/22	(309)	66	.41	.53
N013210	1 1/2 ÷ 2 = ? 3/4	(76)	113	.08	.48

[1]Statistics are given for each item and for each occurrence of an item on different test versions.

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N014000: Addition and Subtraction of Fractions

(a) Reference(s) to the Curriculum Guideline:
     Grade 7   N 3b
     Grade 8   N 2a
     Grade 9 Adv   N 4a
              Gen   N 4a
              Basic N 3f
     Grade 10 Gen   N 1a
              Mod   N 6c (Course C)

(b) Difficulty Level:
     pre-instruction = .47, post-instruction = .86

     Grade 7   .26   .58
     Grade 8   .41   .61
     Grade 9   .46   .77
     Grade 10   .61   .82

OBJECTIVE N014100:   Adding and subtracting fractions with
                     the same denominators

MODEL: a/b - c/b = ? (in lowest terms)
           1 ≤ a,c ≤ 5   a < b   a > c
           2 ≤ b ≤ 10   c < b

EXAMPLES:

           N014101   3/7 - 2/7 = ?   1/7

           N014102   4/9 - 1/9 = ?   1/3

           N014103   2/5 - 2/5 = ?   0

MODEL: a/b + c/b = ? (in lowest terms)
           1 ≤ a,c ≤ 5   a < b
           2 ≤ b ≤ 10   c < b

EXAMPLES:

           N014104   4/8 + 2/8 = ?   3/4

           N014105   3/7 + 5/7 = ?   8/7 or 1 1/7

           N014106   1/5 + 3/5 = ?   4/5

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N014000: Addition and Subtraction of Fractions

OBJECTIVE N014200:   Adding and subtracting fractions with
                     unlike denominators

MODEL: $a/b - c/d$ = ? (lowest terms)
           $a/b > c/d$ $b \neq d$
           $1 \leq a,c \leq 5$ $a < b$
           $2 \leq b,d \leq 6$ $c < d$

EXAMPLES:

         N014201   3/5 - 1/2 = ?   1/10

         N014202   2/5 - 1/4 = ?   3/20

         N014203   3/4 - 2/5 = ?   7/20

MODEL: $a/b + c/d$ = ? (lowest terms)
           $1 \leq a,c \leq 5$ $b \neq d$
           $2 \leq b,d \leq 6$ $a < b$
                                       $c < d$

EXAMPLES:

         N014204   1/3 + 1/6 = ?   1/2

         N014205   3/4 + 2/5 = ?   23/20 or 1 3/20

         N014206   2/3 + 1/4 = ?   11/12

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N014000: Addition and Subtraction of Fractions

OBJECTIVE N014300: Adding and subtracting mixed numbers

MODEL: a c/d - b e/f = ? (lowest terms)
           a c/d > b e/f =   c < d
           $1 \leq$ a,b,c,e $\leq$ 4   e < f
           $2 \leq$ d,f $\leq$ 5   d $\neq$ f

EXAMPLES:

           N014301   2 4/5 - 1 1/2 = ?   13/10 or 1 3/10
           N014302   1 2/3 - 1 1/5 = ?   7/15
           N014303   3 3/4 - 2 1/3 = ?   17/12 or 1 5/12

MODEL: a c/d + b e/f = ?   (lowest terms)
           $1 \leq$ a,b,c,e $\leq$ 4   c < d
           $2 \leq$ d,f $\leq$ 5   c < f
                                d $\neq$ f

EXAMPLES:

           N014304   2 1/4 + 1 1/2 = ?   15/4 or 3 3/4

           N014305   4 2/3 + 2 4/5 = ?   112/15 or 7 7/15

           N014306   1 1/5 + 4 3/4 = ?   119/20 or 5 19/20

Ontario Assessment Instrument Pool

N014400　　Performance Analysis (Instrument Statistics[1]) for Adding and
　　　　　　Subtracting Fractions

Instrument	Reduce your answer to lowest terms	Calibration Sample Size	Average Student Response Time (seconds) n=225	P- Value	Discrimi- nation
N014401	$4\ 1/2 - 1\ 1/5 = ?\ 3\ 3/10$	(175)	74	.53	.55
N014402	$3\ 3/5 - 2\ 1/4 = ?\ 1\ 7/20$	(85)	71	.68	.55
N014403	$1\ 1/5 + 1\ 1/3 = ?\ 2\ 8/15$	(42)	89	.10	.67
N014404	$4\ 2/3 - 1\ 4/5 = ?\ 2\ 13/15$	(354)	64	.44	.51
N014405	$4\ 3/4 + 4\ 1/2 = ?\ 9\ 1/4$	(139)	131	.76	.41
N014406	$2\ 1/4 - 1\ 1/5 = ?\ 1\ 1/20$	(309)	60	.69	.45
		(231)		.74	.56
N014407	$4\ 2/3 + 2\ 2/5 = ?\ 7\ 1/15$	(217)	112	.69	.57
N014408	$3\ 3/4 - 3\ 1/2 = ?\ 1/4$	(524)	98	.7	.6
		(76)		.21	.53
N014409	$3\ 3/5 + 3\ 2/3 = ?\ 7\ 4/15$	(371)	60	.55	.56
N014410	$4\ 1/2 - 3\ 3/5 = ?\ 9/10$	(225)	105	.34	.56
		(655)		.36	.62

[1] Statistics are given for each item and for each occurrence of an item on different
test versions.

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N015000: Conversion of Decimal Fractions to Common
Fractions

(a) Reference(s) to the Curriculum Guideline:
     Grade 7
     Grade 8   N 3a
     Grade 9   Adv   N 4c
               Gen   N 4b
               Basic N 3c
               Mod   N 6d (Courses A,B)
     Grade 10 Mod   N 6d (Courses B,C)

(b) Difficulty Levels
     pre-instruction = .32, post-instruction = .75

     Grade 7   .11   .47
     Grade 8   .32   .45
     Grade 9   .34   .55
     Grade 10   .39   .62

OBJECTIVE N015100:   Conversion of decimal fractions to
                     familiar common fractions

MODEL: Convert the following to common fractions or
          mixed numbers. Reduce all fractions to lowest
          terms
          x = ?
          x is chosen at random from {0.1, 0.125, 0.2, 0.25,
              0.3, 0.375, 0.4, 0.5, 0.6, 0.625, 0.7, 0.75,
              0.8, 0.875, 0.9}
          also 1 + all the above; e.g. N015104-6
          also 2 + all the above; e.g. N015107-9

EXAMPLES:

          N015101   0.375 = ?   3/8

          N015102   0.6   = ?   3/5

          N015103   0.7   = ?   7/10

OBJECTIVE N015100 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N015000: Conversion of Decimal Fractions to Common
Fractions

EXAMPLES:

N015104	1.4	= ?	1 2/5
N015105	1.9	= ?	1 9/10
N015106	1.625	= ?	1 5/8

EXAMPLES:

N015107	2.3	= ?	2 3/10
N015108	2.875	= ?	2 7/8
N015109	2.75	= ?	2 3/4

Ontario Assessment Instrument Pool

N015200   Performance Analysis (Instrument Statistics[1]) for Converting Decimal
           Fractions to Common Fractions

Instrument	Convert to a fraction or mixed number reduced to lowest terms		Calibration Sample Size	Average Student Response Time (seconds) n=172	P-Value	Discrimination
N015201	1.625 = ?	1 5/8	(139)	139	.45	.65
N015202	1.7 = ?	1 7/10	(225)	92	.32	.62
N015203	2.125 = ?	2 1/8	(42)	46	.1	.55
N015204	0.625 = ?	5/8	(524)	78	.42	.61
			(354)		.29	.57
N015205	0.7 = ?	7/10	(85)	58	.74	.42
N015206	0.125 = ?	1/8	(76)	62	.05	.35
N015207	1.75 = ?	1 3/4	(371)	74	.53	.49
			(309)		.67	.48
N015208	1.5 = ?	1 1/2	(175)	57	.37	.44
N015209	1.2 = ?	1 1/5	(217)	13	.41	.68
N015210	1.875 = ?	1 7/8	(655)	39	.17	.56
			(231)		.32	.63

[1]Statistics are given for each item and for each occurrence of an item on different test versions

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Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N016000: Converting Common Fractions to Decimal
Fractions

(a) Reference(s) to the Curriculum Guideline:
Grade 7
Grade 8   N 2b
Grade 9   Adv   N 4c
          Basic N 3c
          Basic A 6d
Grade 10 Mod   N 63 (Courses B,C)

(b) Difficulty Level:
pre-instruction = .20, post-instruction = .49

Grade 7   .04   .13
Grade 8   .24   .24
Grade 9   .20   .40
Grade 10   .22   .69

OBJECTIVE N016100: Converting common fractions to decimal
fractions

MODEL: Convert to decimal form, rounding answers to
           three decimal places

           x/y = ?
           $2 \le y \le 50$
           $1 \le x < y$
EXAMPLES:

           N016101   4/23 = ?   0.174

           N016102   9/20 = ?   0.45

           N016103   12/47 = ?   0.255

MODEL: Convert to decimal form, rounding answers to
           three decimal places

           x/y = ?
           $2 \le y \le 50$
           $1 \le x < 9xy$

OBJECTIVE N016100 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N016000: Converting Common Fractions to Decimal
Fractions
EXAMPLES:

N016104	12/5	= ?	2.4
N016105	567/21	= ?	27.0
N016106	27/12	= ?	2.25

N016200 Performance Objective (Instrument Statistics[1]) on Converting Common Fractions to Decimal Fractions

Instrument	Convert to a decimal fraction, rounding to three places	Calibration Sample Size	Average Student Response Time (Seconds) n= 161	P-Value	Discrimination
N016201	41/15 = ? 2.733	(217)	207	.35	.58
		(225)		.16	.5
N016202	53/13 = ? 4.077	(231)	130	.16	.47
N016203	23/39 = ? 0.59	(309)	149	.18	.43
N016204	83/30 = ? 2.767	(76)	175	.1	.3
		(42)		.1	.3
N016205	23/30 = ? 0.767	(139)	125	.22	.5
N016206	37/10 = ? 3.7	(371)	73	.50	.49
N016207	21/43 = ? 0.488	(85)	44	.35	.75
N016208	89/11 = ? 8.091	(175)	173	.15	.31
		(524)		.20	.39
N016209	29/33 = ? 0.879	(354)	91	.25	.54
N016210	104/21 = ? 4.952	(655)	245	.16	.58

[1] statistics are given for each item and for each occurrence of an item on different test versions

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Mathematics for the Intermediate Division

TOPIC N017000:   Two Term Ratios

(a)   Reference(s) to the Curriculum Guideline:
      Grade 7   N 3d
      Grade 8   N 2d
      Grade 9   Adv   N 5d
                Gen   N 6a
                Basic N 4a
      Grade 10 Gen   N 2a

(b)   Difficulty Level:
      pre-instruction = .28, post-instruction = .58

      Grade 7   .12   .34
      Grade 8   .33   .34
      Grade 9   .26   .47
      Grade 10   .32   .50

OBJECTIVE N017100:   Expressing ratios in fraction form

MODEL: In a hockey game, team 1 scored x goals and
           team 2 scored y goals. In fraction form the ratio
           of team 1's goals to team 2's goals is?
           $1 \leq x,y \leq 10$

EXAMPLES:

           N017101   In a hockey game, Vancouver scored
                      7 goals and Toronto scored 1 goal.
                      In fraction form, the ratio of
                      Vancouver's goals to Toronto's goals
                      is?   7/1

OBJECTIVE N017100 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N017000: Two Term Ratios

    N017102:   In a hockey game, Buffalo scored
               3 goals and Montreal scored 2 goals.
               In fraction form, the ratio of
               Buffalo's goals to Montreal's goals
               is?   3/2
    N017103   In a hockey game, Detroit scored
               1 goal and Chicago scored 4 goals.
               In fraction form, the ratio of
               Detroit's goals to Chicago's goals
               is?   1/4

MODEL: In fraction form, the ratio x:y is ?
           $1 \leq x,y \leq 50$ x/y is in lowest terms

EXAMPLES:

    N017104   In fraction form, the ratio 3:4

               is ?   3/4

    N017105   In fraction form, the ratio 1:6

               is ?   1/6

    N017106   In fraction form, the ratio 17:4

               is ?   17/4

OBJECTIVE N017100 (cont'd)

Mathematics for the Intermediate Division

TOPIC N017000: Two Term Ratios

MODEL: Name 's garden produced x tomatoes and y
          cucumbers. In fraction form, the ratio of
          tomatoes to cucumbers is ?
          $1 \leq x,y \leq 10$

EXAMPLES:

> N017107   Betty's garden produced 7 tomatoes
>   and 29 cucumbers. In fraction form,
>   the ratio of tomatoes to cucumbers
>   is ?   7/29
>
> N017108   David's garden produced 5 dozen tomatoes
>   and 8 dozen cucumbers. In fraction form,
>   the ratio of tomatoes to cucumbers
>   is ?   5/8
>
> N017109   Mary's garden produced 13 tons of
>   tomatoes and 27 tons of cucumbers.
>   In fraction form, the ratio of tomatoes
>   to cucumber is ?   13/27

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N017000: Two Terms Ratios

OBJECTIVE N017200: Reducing to lowest terms

MODEL: The ratio x:y written in fraction
           form to the lowest terms is ?
           $x = nw$ $1 \leq w,z \leq 10$
           $y = nz$ $1 \leq n \leq 10$ $w \neq z$

EXAMPLES:

    N017201   The ratio 4:8 written in fraction
               form to the lowest terms is ?
               1/2
    N017202   The ratio 50:20 written in fraction
               form to the lowest terms is ?
               5/2
    N017203   The ratio 9:27 written in fraction
               form to the lowest terms is ?
               1/3

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N017000: Two Term Ratios

OBJECTIVE N017300:   Checking for equivalent ratios
                      using cross products

MODEL: x/y   w/z
           Are these ratios equivalent? (yes or no)

EXAMPLES:

           N017301   9/29   4/8
                      Are these ratios equivalent?
                      (yes or no)   no
           N017302   16/64   3/12
                      Are these ratios equivalent?
                      (yes or no)   yes
           N017303   11/4   88/32
                      Are these ratios equivalent?
                      (yes or no)   yes

MODEL: x:y   w:z
           Are these ratios equivalent? (yes or no)
           x = ma   w = na
           y = mb   z = nb
           $1 \leq a,b \leq 6$ or $1 \leq x,y,w,z \leq 30$
           $1 \leq n,m \leq 5$ $xz \neq wy$
           $n \neq m$
           $a \neq b$

OBJECTIVE N017300 (cont'd)

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Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N017000: Two Term Ratios

EXAMPLES:

        N017304   20:24   25:30
                    Are these ratios equivalent?
                    (yes or no)   yes
        N017305   29:10   7:16
                    Are these ratios equivalent?
                    (yes or no)   no
        N017306   21:12   11:5
                    Are these ratios equivalent?
                    (yes or no)   no

Mathematics for the Intermediate Division

TOPIC N017000: Two Term Ratios

OBJECTIVE N017400:   Solving for an unknown in
                     equivalent ratios

MODEL: a:b = x:d
          x = ?
          1 ≤ a,b,c,d ≤ 15
          a ≠ c
          b ≠ d

EXAMPLES:

          N017401   5:13 = x:2

                         x = ?   10/13

          N017402   3:4 = x:12

                         x = ?   9

          N017403   1:5 = x:18

                         x = ?   18/5

MODEL: a/b = x/d
            x = ?

EXAMPLES:

          N017404   15/5 = x/8

                         x = ?   24

          N017405   3/8 = x/12

                         x = ?   9/2

          N017406   5/1 = x/6

                         x = ?   30

OBJECTIVE N017400 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N017000: Two Term Ratios

MODEL: a/x = c/d
          x = ?

EXAMPLES:

        N017407   6/x = 10/1
                     x = ?   3/5
        N017408   3/x = 12/4
                     x = ?   1
        N017409   13/x = 5/2
                     x = ?   26/5

Ontario Assessment Instrument Pool

N017500 Performance Analysis (Instrument Statistics[1]) for Two-Term Ratios

Instrument	Reduce your answer to lowest terms	Calibration Sample Size	Average Student Response Time (Seconds) n=142	P-Value	Discrimination
N017501	8:x = 4:12, x = ? 24	(85) (354)	51	.53 .40	.64 .56
N017502	8:4 = x:14, x = ? 28	(225) (655)	87	.21 .23	.45 .59
N017503	12/13 = 2/x, x = ? 13/6 or 2 1/6	(231)	70	.2	.48
N017504	6/7 = x/13, x = ? 78/7 or 11 1/7	(309)	80	.13	.31
N017505	x:9 = 11:3, x = ? 33	(371)	109	.41	.44
N017506	x/14 = 12/6, x = ? 28	(139) (76)	22	.74 .09	.36 .25
N017507	14:7 = x:15, x = ? 30	(217)	74	.3	.64
N017508	x:15 = 11:3, x = ? 55	(524)	96	.36	.61
N017509	4/11 = 7/x, x = ? 77/4 or 19 1/4	(175)	52	.07	.25

[1]Statistics are given for each item and for each occurrence of an item on different test versions.

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N018000: Expressing Percent in Different Ways

(a) Reference(s) to the Curriculum Guideline:
     Grade 7   N 4b
     Grade 8   N 2e
     Grade 9   Adv   N 5a
               Gen   N 5a
               Basic N 5b
               Mod   N 4a (Courses A,B)
     Grade 10 Mod   N 4b (Course C)

(b) Difficulty Level:
     pre-instruction = .17, post-instruction = .64

     Grade 7   .04   .25
     Grade 8   .11   .30
     Grade 9   .16   .37
     Grade 10   .27   .33

OBJECTIVE N018100: Expressing decimals as percents and
                   vice versa

MODEL: a% expressed as a decimal fraction = ?
           $1 \leq a \leq 250$ or $1.1 \leq a \leq 250.0$

EXAMPLES:

           N018101   157% expressed as a decimal fraction
                     = ?   1.57

           N018102   2.8% expressed as a decimal fraction
                     = ?   0.028

           N018103   200% expressed as a decimal fraction
                     = ?   2.0

OBJECTIVE N018000 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N018000: Expressing Percent in Different Ways

MODEL: a expressed as a percent = ?
           (correct to one decimal place)
           $0.010 \le a \le 2.500$

EXAMPLES:

      N018104   0.143 expressed as a percent = ?

                 14.3%

      N018105   1.56 expressed as a percent = ?

                 156%

      N018106   5.036 expressed as a percent = ?

                 503.6%

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N018000: Expressing Percent in Different Ways

OBJECTIVE N018200: Expressing percents as ratios

MODEL: x% expressed as a ratio in lowest terms = ?
           x = yz
           y $\in \{1,5\}$
           $1 \leq z \leq 50$ z   N

EXAMPLES:

           N018201   20% expressed as a ratio in
                      lowest terms = ?   1/5
           N018202   130% expressed as a ratio in
                      lowest terms = ?   13/10
           N018203   30% expressed as a ratio in
                      lowest terms = ?   3/10

Mathematics for the Intermediate Division

TOPIC N018000: Expressing Percent in Different Ways

OBJECTIVE N018300: Expressing ratios as percents

MODEL: a:b expressed as a percent to the nearest
          tenth = ?
          $b \in \{2,4,5,10,20,25,50\}$ $1 \leq a \leq 2b$

EXAMPLES:

    N018301   1:10 expressed as a percent to the
           nearest tenth = ?   10%

    N018302   24:25 expressed as percent to the
           nearest tenth = ?   96%

    N018303   8:4 expressed as a percent to the
           nearest tenth = ?   200%

MODEL: a/b expressed as a percent to the nearest
          tenth = ?
          $b \in \{2,4,5,10,20,25,50\}$ $1 \leq a \leq 2b$

EXAMPLES:

    N018304   18/10 expressed as a percent to the
           nearest tenth = ?   180%

    N018305   2/5 expressed as a percent to the
           nearest tenth = ?   40%

    N018306   9/50 expressed as a percent to the
           nearest tenth = ?   18%

Mathematics for the Intermediate Division

TOPIC N018000: Expressing Percent in Different Ways

OBJECTIVE N018400:   Converting percents, ratios, and
decimals

MODEL: a% expressed as a decimal fraction = ?
$1 \leq a \leq 250$ or $1.1 \leq a \leq 250.0$

EXAMPLES:

      N018401   100.9% expressed as a decimal

                 fraction = ?   1.009

      N018402   53% expressed as a decimal

                 fraction = ?   .53

      N018403   204.6 expressed as a decimal

                 fraction = ?   2.046

MODEL: a% expressed as a ratio in lowest terms = ?
$x = yz$
$y \in \{1,5\}$
$1 \leq z \leq 50$ $z \in N$

EXAMPLES:

      N018404   60% expressed as a ratio in lowest
                 terms = ? 3/5

      N018405   12% expressed as a ratio in lowest
                 terms = ? 3/25

      N018406   200% expressed as a ratio in lowest
                 terms = ? 2/1

OBJECTIVE N018400 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N018000: Expressing Percent in Different Ways

MODEL: a:b expressed as a percent to the nearest
          tenth = ?
          b ∈ {2,4,5,10,20,25,50}
          1 ≤ a ≤ 2b

EXAMPLES:

N018407   7:10 expressed as a percent to the
           nearest tenth = ?   70%

N018408   40:25 expressed as a percent to the
           nearest tenth = ?   160%

N018409   7:4 expressed as a percent to the
           nearest tenth = ?   175%

Ontario Assessment Instrument Pool

N018500 Performance Analysis (Instrument Statistics[1]) for Expressing Percent in Different Ways

Instrument		Calibration Sample Size	Average Student Response Time (Seconds) n=90	P-Value	Discrimination
N018501	6:5 expressed as a percent to the nearest tenth = ? 120%	(85)	85	.35	.75
N018502	114.6% expressed as a decimal fraction = ? 1.146	(354)	50	.07	.36
N018503	22% expressed as a ratio in lowest terms = ? 11:50	(225) (231)	62	.24 .20	.58 .48
N018504	4:2 expressed as a percent to the nearest tenth = ? 200%	(371)	61	.09	.51
N018505	57.17% expressed as a ratio = ? 57.17:100	(309) (217)	23	.16 .18	.34 .53
N018506	1/3 expressed as a percent nearest tenth = ? 33.3%	(655) (76)	60	.16 .04	.54 .33
N018507	1:7 expressed as a percent to the nearest tenth = ? 14.3%	(139)	48	.20	.54
N018508	10/5 expressed as a percent to the nearest tenth = ? 200%	(175)	69	.14	.32
N018509	21% expressed as a ratio in lowest terms = ? 21:100	(524)	26	.36	.61
N018510	47% expressed as a ratio in lowest terms = ? 47:100	(42)	84	.55	.40

[1] Statistics are given for each item and for each occurrence of an item on different test versions.

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC NO19000: Working With Percent

(a) Reference(s) to the Curriculum Guideline:
    Grade 7   N 4b
    Grade 8   N 2e
    Grade 9 Adv   N 5a
             Gen   N 5a
             Basic N 5b
             Mod   N 4a (Courses A, B)
    Grade 10 Mod   N 4b (Course C)

(b) Difficulty Level:
    pre-instruction = .23, post-instruction = .62

Grade		
Grade 7	.09	.28
Grade 8	.27	.32
Grade 9	.21	.43
Grade 10	.29	.41

OBJECTIVE NO19100:   Finding what percent one number is of
                    another number

MODEL: What percent of y is x? (to the nearest
           percent)
           $10 \le y \le 100$
           $0 < x \le y + 20$

EXAMPLES:

NO19101	What percent of 90 is 29?	32%
NO19102	26 is what percent of 11?	236%
NO19103	What percent of 88 is 8?	9%

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

OBJECTIVE NO19200: Finding a percent of an amount

MODEL: What number is x% of y? (to the nearest whole
            number)
            or x% of y = ? (to the nearest whole number)
            0 < x < 150
            10 < y < 120 and a multiple of 5
            x and y are not both greater than 100

EXAMPLES:

            NO19201   What number is 40% of 70?   28
            NO19202   46% of 10   = ?   5
            NO19203   119% of 55   = ?   65

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

OBJECTIVE N019300:   Finding the whole amount when
                     a part is known

MODEL: x of what number is y%? (to the nearest
            whole number)
            or y% of what number is x? (to the nearest
            whole number)
            1 $\leq$ y $\leq$ 150 and a multiple of 5
            10 $\leq$ y $\leq$ 100   x < y

EXAMPLES:

            N019301   30 of what number is 115%?   26
            N019302   46 of what number is 90%?   51
            N019303   145% of what number is 44?   30

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

OBJECTIVE NO19400:   Solving a variety of percent
                      problems

MODEL: x of y is what percent? (to the nearest
            percent)
            $10 \leq y \leq 100$
            $0 < x \leq y + 20$

EXAMPLES:

          NO19401   61 of 95 is what percent?   64%

          NO19402   107 of 87 is what percent?   123%

          NO19403   4 of 24 is what percent?   17%

MODEL: x% of y = ? (to the nearest whole number)
            $0 < x < 150$
            $10 < y < 120$ x and y are not both greater than 100
                      y is a multiple of 5

EXAMPLES:

          NO19404   74% of 60   = ?   44

          NO19405   133% of 15   = ?   20

          NO19406   12% of 115   = ?   14

MODEL: y% of what number = x? (to the nearest
                                whole number)
            $1 \leq y \leq 150$ and a multiple of 5
            $10 \leq x \leq 100$ $x < y$

EXAMPLES:

          NO19407   150% of what number = 32?   21

          NO19408   35% of what number   = 90?   257

          NO19409   100% of what number = 17?   17

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N019500 Performance Analysis (Instrument Statistics[1]) for Working with Percent

Instrument		Calibration Sample Size	Average Student Response Time (Seconds) n=63	P-Value	Discrimination
N019501	5 is what percent of 20%? 25%	(371) (231)	166	.30 .45	.41 .50
N019502	34 is what percent of 40? 85%	(354)	120	.39	.63
N019503	What number is 133% of 55 (to the nearest whole number)? 73	(217)	55	.17	.50
N019504	70 is 75% of what number (to the nearest whole number)? 93	(76)	237	.01	.02
N019505	30% of what number is 28 (to the nearest whole number)? 93	(309)	170	.07	.22
N019506	97% of 35 = ? 34	(42)	206	.02	.55
N019507	87 out of 88 is what percent (to the nearest tenth)? 98.9%	(139)	16	.16	.29
N019508	What percent is 21 out of 14? 150%	(225)	140	.12	.52
N019509	30 is what percent of 15? 200%	(655) (524)	99	.26 .33	.53 .58
N019510	25 out of 72 is what percent (to the nearest percent)? 35%	(175) (85)	51	.10 .31	.31 .65

[1]Statistics are given for each item and for each occurrence of an item on different test versions.

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N020000: Adding Integers

(a) Reference(s) to the Curriculum Guideline:
    Grade 7   N 6c
    Grade 8   N 5c
    Grade 9   Gen   N 1a
              Basic N 8c
    Grade 10

(b) Difficulty Level:
    pre-instruction = .60, post-instruction = .88

    Grade 7   .20   .37
    Grade 8   .70   .78
    Grade 9   .57   .75
    Grade 10   .71   .90

OBJECTIVE N020100: Extending numbers to the other side
                   of zero

MODEL: Which is the smallest number, a, b, or c?
           a, b, and c are integers between -50 and 50

EXAMPLES:

           N020101   Which is the smallest number, 11, -25
                      or -50?   -50

           N020102   Which is the smallest number, -37, -9
                      or 6?   -37

           N020103   Which is the smallest number, 31, 1,
                      or -4?   -4

MODEL: Which is the largest number, a, b, or c?
           a, b, and c are integers between -50 and 50

OBJECTIVE N020100 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N020000: Adding Integers

EXAMPLES:

    N020104   Which is the largest number, -1, 16, or -29? 16

    N020105   Which is the largest number, 2, -5, or -41? 2

    N020106   Which is the largest number, -19, -25, or -49? -19

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N020000. Adding Integers

OBJECTIVE N020200: Adding two integers

MODEL: a + b = ?
          a is an integer between -10 and 10   a ≠ 0
          1 ≤ b ≤ 10

EXAMPLES:

          N020201   6 + (-7) = ?   -1
          N020202   -3 + 5   = ?   2
          N020203   3 + (-2) = ?   1

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N020000: Adding Integers

OBJECTIVE N020300: Adding integers

MODEL: a + b + (-c) = ?
          c is an integer between -50 and 50,
          c ≠ 0
          a and b are integers between 1 and 50

EXAMPLES:

          N020301   6 + 47 + (-29) = ?   24

          N020302   29 + 17 +(-14) = ?   32

          N020303   15 + 19 + 31   = ?   65

MODEL: a + (-b) + c = ?
          b is an integer between -50 and 50, b ≠ 0
          a and c are integers between 1 and 50

EXAMPLES:

          N020304   35 + (-19) + 10 = ?   26

          N020305   6 + (-27) + 19   = ?   -2

          N020306   7 + (-31) + 50   = ?   26

MODEL: (-a) + (b) + c = ?
          a and b are integers between -50 and 50, a,b ≠ 0
          c is an integer between 1 and 50

EXAMPLES:

          N020307 (-33) + (-16) + 32 = ?   -17

          N020308 (-4) + (-44) + 16 = ?   -32

          N020309 (-21) + (-19) + 42 = ?   2

Ontario Assessment Instrument Pool

N020400   Performance Analysis (Instrument Statistics[1]) for Adding Integers

Instrument			Calibration Sample Size	Average Student Response Time (seconds) n=2460	P-Value	Discrimination
N020401	35 + 22 + (-19)	= ? 38	(371)	130	.76	.34
			(217)		.71	.59
N020402	-25 + (-19) + (-47)	= ? -91	(524)	140	.68	.51
N020403	42 + 15 + (-42)	= ? 15	(85)	140	.68	.53
N020404	-12 + 33 + 46	= ? 67	(225)	129	.67	.39
			(231)		.75	.44
N020405	-12 + 11 + (-15)	= ? -16	(42)	131	.74	.48
N020406	-19 + (-32) + 27	= ? -24	(309)	142	.61	.44
			(655)		.44	.55
N020407	1 + (-50) + (-41)	= ? -90	(139)	138	.71	.57
N020408	12 + 9 + (-12)	= ? 9	(76)	135	.51	.25
N020409	-3 + 42 + 25	= ? 64	(175)	131	.69	.49
N020410	11 + 16 + (-1)	= ? 26	(354)	128	.72	.59

[1]Statistics are given for each item and for each occurrence of an item on different test versions.

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Mathematics for the Intermediate Division

TOPIC N021000: Subtracting Integers

(a) Reference(s) to the Curriculum Guideline:
    Grade 7   N 6c
    Grade 8   N 5c
    Grade 9 Gen   N 1a
            Basic N 8c
    Grade 10

(b) Difficulty Level:
    pre-instruction = .40, post-instruction = .79

    Grade 7   .06   .26
    Grade 8   .40   .54
    Grade 9   .34   .59
    Grade 10   .60   .79

OBJECTIVE N021100:   Subtracting integers

MODEL: $a - (-b)$ = ? $5 \leq a \leq 20$ or $-20 \leq a \leq -5$
                            $5 < b$

EXAMPLES:

        N021101 $-8 - (-8)$ = ?   0

        N021102 $17 - (-11)$ = ?   28

        N021103 $-20 - (-14)$ = ?   -6

MODEL: $a - b - c$ = ? $5 \leq a \leq 20$ or $-20 \leq a \leq -5$
                            $5 < b, c < 20$

EXAMPLES:

        N021104 $12 - 19 - 11$ = ?   -18

        N021105 $7 - 15 - 4$ = ?   -12

        N021106 $-17 - 6 - 17$ = ?   -40

OBJECTIVE N021100 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N021000: Subtracting Integers

MODEL: a - (-b) - c = ? $5 \leq a \leq 20$ or $-20 \leq a \leq -5$
                             $5 < b, c < 20$

EXAMPLES:

N021107	-6 - (-7) - 17 = ?	-16
N021108	-23 - (-23) - 12 = ?	-12
N021109	15 - (-26) - 4 = ?	37

Mathematics for the Intermediate Division

TOPIC N021000: Subtracting Integers

OBJECTIVE N021200: Adding and subtracting integers

MODEL: $a - (-b) + c = ?$ $-15 \leq a \leq 15$ $a \neq 0$
                                   $16 \leq b \leq 25$
                                   $26 \leq c \leq 35$

EXAMPLES:

      N021201 $-12 - (-19) + 35 = ?$ 42

      N021202 $6 - (-16) + 21 = ?$ 43

      N021203 $-11 - (-22) + 26 = ?$ 37

MODEL: $a - b + c - d = ?$ $-15 \leq a \leq 15$ $a \neq 0$
                                   $16 \leq b \leq 25$
                                   $26 \leq c \leq 35$
                                    $1 \leq d \leq 10$

EXAMPLES:

      N021204 $-5 - 18 + 29 - 3 = ?$ 3

      N021205 $12 - 35 + 35 - 10 = ?$ 12

      N021206 $-13 - 16 + 28 - 8 = ?$ -9

MODEL: $a - b - (-c) = ?$ $15 \leq a \leq 15$ $a \neq 0$
                                   $16 \leq b \leq 25$
                                   $26 \leq c \leq 35$

EXAMPLES:

      N021207 $-6 - 20 -(-34) = ?$ 8

      N021208 $13 - 24 - (-29) = ?$ 18

      N021209 $-15 - 18 - (-26) = ?$ -7

Ontario Assessment Instrument Pool

N021300   Performance Analysis (Instrument Statistics[1]) for Subtracting Integers

Instrument		Calibration Sample Size	Average Student Response Time (seconds) n=1980	P-Value	Discrimination
N021301	-7 + 25 - 26 - 10 = ? -18	(309)	120	.56	.43
		(175)		.50	.53
N021302	8 - 24 - (-27) + 8 = ? 19	(76)	120	.13	.16
N021303	-15 - (-16) + 29 = ? 30	(42)	128	.00	-
N021304	-3 - 19 + 33 - 1 = ? 10	(139)	98	.70	.57
N021305	-8 - 18 - (-26) = ? 0	(85)	108	.45	.58
		(225)		.39	.44
N021306	-3 - (-24) - 28 - (-4) = ? -3	(371)	110	.50	.50
N021307	2 + 18 - (-33) = ? 53	(524)	114	.56	.69
N021308	12 + 22 - (-33) + 7 = ? 74	(655)	112	.25	.53
N021309	-13 - 17 + 35 = ? 5	(354)	116	.51	.58
		(217)		.54	.63
N021310	-8 + 20 - 28 - 6 = ? -22	(231)	100	.56	.57

[1] Statistics are given for each item and for each occurrence of an item on different test versions.

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N022000: Multiplying Integers

(a) Reference(s) to the Curriculum Guideline:
    Grade 7
    Grade 8   N 5d
    Grade 9 Adv. N 1b
             Gen. N 1b
             Basic N 8c
    Grade 10

(b) Difficulty Level:
    pre-instruction = .58, post-instruction = .90

    Grade 7   .07   .13
    Grade 8   .64   .83
    Grade 9   .54   .84
    Grade 10   .75   .90

OBJECTIVE N022100: Multiplying integers

MODEL: a x b = ? -10 $\leq$ a,b $\leq$ 10
           a,b $\neq$ 0   If a is positive, b must be negative
                        If a is negative, b is random

EXAMPLES:

           N022101   -2 x 7 = ?   -14

           N022102   9 x -4 = ?   -36

           N022103   -7 x -3= ?   21

MODEL: a x b x c = ? -10 $\leq$ a,b,c $\leq$ 10
           a, b, c $\neq$ 0   If a is positive, b must be negative
                          If a is negative, b is random

EXAMPLES:

           N022104   -5 x 9 x -7 = ?   315

           N022105   8 x -10 x 7 = ?   -560

           N022106   -6 x -4 x -5 = ?   -120

N022200   Performance Analysis (Instrument Statistics[1]) for Multiplying Integers

Instrument		Calibration Sample Size	Average Student Response Time (seconds) n=2460	P-Value	Discrimination
N022201	-5 x 5 x -6 = ? 150	(225)	75	.56	.46
N022202	1 x -10 = ? -10	(175)	107	.77	.42
N022203	7 x -3 x 3 = ? -63	(76)	98	.26	.43
N022204	0 x -6 = ? 0	(217)	93	.7	.59
N022205	8 x -4 x 8 = ? -256	(85)	88	.45	.7
		(309)		.58	.56
N022206	-2 x -2 = ? 4	(231)	111	.83	.48
		(655)		.48	.61
N022207	6 x -6 x -6 = ? 216	(42)	84	.64	.46
N022208	-3 x -5 = ? 15	(139)	97	.86	.52
N022209	1 x -7 x -10 = ? 70	(354)	84	.59	.67
		(524)		.68	.61
N022210	2 x -5 = ? -10	(371)	83	.85	.35

[1]Statistics are given for each item and for each occurrence of an item on different test versions.

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N023000: Dividing Integers

(a) Reference(s) to the Curriculum Guideline:
      Grade 7
      Grade 8   N 5d
      Grade 9   Adv   N 1b
                Gen   N 1b
                Basic N 8c
      Grade 10

(b) Difficulty Level:
      pre-instruction = .59, post-instruction = .94

Grade 7	.15	.29
Grade 8	.61	.86
Grade 9	.56	.86
Grade 10	.77	.93

OBJECTIVE N023100: Dividing integers

MODEL: $b/a = ?$
          $-12 \leq a \leq 12 \quad a \neq 0$
          $-144 \leq b \leq 144$ and b is a multiple of a

EXAMPLES:

N023101	$-3/3$	$= ?$	-1
N023102	$-90/10$	$= ?$	-9
N023103	$-12/-12$	$= ?$	1

Ontario Assessment Instrument Pool

N023200 Performance Analysis (Instrument Statistics[1]) for Dividing Integers

Instrument			Calibration Sample Size	Average Student Response Time (Seconds) n=2044	P-Value	Discrimi-nation
N023201	$4 \div -2$	= ? -2	(524)	76	.72	.58
			(371)		.83	.43
N023202	1/-1	= ? -1	(655)	80	.45	.58
			(354)		.54	.64
N023203	$2 \div -2$	= ? -1	(42)	82	.76	.38
N023204	-1/1	= ? 1	(85)	78	.54	.69
N023205	$16 \div -4$	= ? -4	(139)	79	.86	.48
N023206	-18/9	= ? 2	(175)	88	.55	.44
N023207	$24 \div -6$	= ? -4	(225)	85	.72	.45
N023208	$33 \div -11$	= ? -3	(309)	83	.67	.53
N023209	$-30 \div 6$	= ? -5	(76)	78	.43	.44
			(217)		.74	.61
N023210	$-30 \div 10$	= ? -3	(231)	79	.87	.4

[1]Statistics are given for each item and for each occurrence of an item on different test versions.

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<u>Mathematics for the Intermediate Division</u>

TOPIC N024000: Multiplying Rational Numbers in
              Fraction Form

(a) Reference(s) to the Curriculum Guideline:
     Grade 7
     Grade 8
     Grade 9   Adv N 4a
                Gen N 4a
     Grade 10

(b) Difficulty Level:
     pre-instruction = .28, post-instruction = .83
     Grade 7   .04   .12
     Grade 8   .20   .57
     Grade 9   .31   .66
     Grade 10   .41   .78

OBJECTIVE N024100:   Rational numbers

MODEL: $ax/bx = ?$
            $1 \le x \le 6$
            $-5 \le a \le 5$ $a \ne 0$
            $-6 \le b \le 6$ $b \ne 0$
            $|a| < |b|$

EXAMPLES:

            N024101 $-12/-24 = ?$ $1/2$
            N024102 $-18/36 = ?$ $-1/2$
            N024103 $-28/-4 = ?$ 7

Mathematics for the Intermediate Division

TOPIC N024000: Multiplying Rational Numbers in
             Fraction Form

OBJECTIVE N024200: Multiplying rationals (fraction form)

MODEL: a/b x c/d = ?
            -6 ≤ a,c ≤ 6   a,c ≠ 0
            -9 ≤ b,d ≤ 9, excluding (-1,0,1)
            |a| < |b|, |c| < |d|

EXAMPLES:

            N024201   -4/-7 x (-4/9) = ?   -16/63

            N024202   -1/8 x (-3/5) = ?   3/40

            N024203   2/-3 x (-5/-7)= ?   -10/21

MODEL: c a/b x d/e = ?
            -3 ≤ c ≤ -1
            1 ≤ a ≤ 4   a < b
            2 ≤ b ≤ 5   b ≠ 0
            -4 ≤ d ≤ 4
            -5 ≤ e ≤ 5   e ≠ -1,0,1
            |d| < |e|

EXAMPLES:

            N024204   -1 2/4 x (-4/-5) = ?   -1 1/5

            N024205   -1 4/5 x (-2/4) = ?   9/10

            N024206   -3 1/3 x (3/-5) = ?   2

N024300   Performance Analysis (Instrument Statistics[1]) for Multiplying Rational Numbers in Fraction Form

Instrument		Calibration Sample Size	Average Student Response Time (seconds) n=1495	P-Value	Discrimination
	Express your answer in simplest terms.				
N024301	-3/4 x -3/-8 = ? -9/32	(655)	80	.19	.55
N024302	1/3 x (-6) = ? -2	(175)	98	.43	.47
		(85)		.35	.72
N024303	3/8 x -5/-9 = ? 5/24	(76)	80	.03	.21
N024304	-3 4/5 x 1/4 = ? -19/20	(231)	95	.54	.64
N024305	-4/6 x -6 = ? 4	(139)	91	.58	.59
N024306	2/-9 x 6/8 = ? -1/6	(371)	79	.46	.63
		(225)		.33	.58
N024307	2 4/5 x -3/5 = ? -42/25	(524)	99	.35	.64
N024308	-1/2 x 16 = ? -8	(309)	119	.57	.56
		(354)		.55	.69
N024309	-1/9 x -1/-8 = ? -1/72	(217)	79	.41	.63
N024310	-1 4/5 x -1/-5 = ? -9/25	(42)	87	.05	.5

[1] Statistics are given for each item and for each occurrence of an item on different test versions.

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Mathematics for the Intermediate Division

TOPIC N025000: Dividing Rational Numbers in Fraction Form

(a)   Reference(s) to the Curriculum Guideline:
      Grade 7
      Grade 8
      Grade 9 Adv   N 4a
              Gen   N 4a
      Grade 10

(b)   Difficulty Level:
      pre-instruction = .20, post-instruction = .75

Grade 7	.02	.09
Grade 8	.08	.47
Grade 9	.19	.54
Grade 10	.35	.69

OBJECTIVE N025100: Dividing rationals (fraction form)

MODEL: $(a\ b/c)/(d/e) = ?$
           $-2 \le a \le 2$ $a \ne 0$
           $-3 \le d \le 3$ $d \ne 0$
           $-4 \le e \le 4$ $e \ne -1,0,1$
           $1 \le b \le 3$
           $2 \le c \le 4$ $b < c$

EXAMPLES:

           N025101 $(-2\ 2/3) / (1/-3) = ?$ 8

           N025102 $(\ 1\ 2/4) / (1/-2) = ?$ -3

           N025103 $(\ 2\ 1/2) / (-3/4) = ?$ -3 1/3

MODEL: $(a\ b/c) / d = ?$
           $a \in \{-1,-2,-3\}$ $-6 \le d \le 6$
           $1 \le b \le 4$ $b < c$
           $2 \le c \le 6$ $d \ne -1,0,1$

OBJECTIVE N025100 (cont'd)

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<u>Mathematics for the Intermediate Division</u>

TOPIC N025000: Dividing Rational Numbers in Fraction Form

EXAMPLES:

N025104	(-1 1/5) / 3 = ?	-2/5
N025105	(-3 2/3) / -5 = ?	11/15
N025106	(-1 1/6) / 6 = ?	-7/36

Ontario Assessment Instrument Pool

N025200   Performance Analysis (Instrument Statistics[1]) for Dividing Rational Numbers in Fraction Form

Instrument		Calibration Sample Size	Average Student Response Time (seconds) n=1524	P-Value	Discrimination
N025201	(-1 3/4) ÷ (2/3) = ? -2 5/8	(175)	71	.15	.37
		(371)		.29	.60
		(231)		.43	.60
N025202	2 3/4 ÷ -1 3/4 = ? -1 4/7	(139)	59	.35	.44
N025203	2/-7 ÷ 3/4 = ? -8/21	(42)	64	.10	.48
N025204	(-2 1/3) ÷ 3 = ? -7/9	(309)	74	.30	.57
		(217)		.39	.72
N025205	1 2/3 ÷ 1/-2 = ? -3 1/3	(225)	63	.21	.60
N025206	(2 2/4) ÷ (2 2/3) = ? 15/16	(85)	54	.39	.69
N025207	6/7 ÷ 4/-7 = ? -1 1/2	(655)	74	.16	.57
N025208	-3 2/3 ÷ -4 = ? 11/12	(76)	76	.00	-
N025209	(-1 2/4) ÷ (-2/-3) = ? -2 1/4	(354)	79	.31	.56
		(524)		.35	.62

[1]Statistics are given for each item and for each occurrence of an item on different test versions.

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<u>Mathematics for the Intermediate Division</u>

TOPIC N026000: Adding and Subtracting Rational
             Numbers in Fraction Form

(a) Reference(s) to the Curriculum Guideline:
     Grade 7
     Grade 8
     Grade 9   Adv N 4a
               Gen N 4a
     Grade 10

(b) Difficulty Level:
     pre-instruction = .26, post-instruction = .67

     Grade 7   .11   .11
     Grade 8   .36   .35
     Grade 9   .22   .39
     Grade 10   .31   .65

OBJECTIVE N026100: Adding rationals (fraction form)

MODEL: $a/b + c/d = ?$
           $-5 \le a,c \le 5$ $a,c \ne 0$
           $-6 \le b,d \le 6$ $b,d \ne -1,0,1$
           $|a| \le |b|,$ $|c| \le |d|$ $b \ne d$

EXAMPLES:

           N026101 $1/-2 + (-5/-6) = ?$ 1/3
           N026102 $-3/6 + (-2/4) = ?$ -1
           N016103 $-5/6 + (3/-4) = ?$ -17/12

MODEL: $c\ a/b + d\ e/f = ?$
           $-2 \le c,d \le z$ $c,d \ne 0$
           $1 \le a,e \le 3$ $a < b$
           $2 \le b,f \le 4$ $e < f$ $b \ne f$

EXAMPLES:

     N026104   2 2/3 + 1 1/2   = ?   4 1/6
     N026105   -1 1/4 + -2 2/3 = ?   -3 11/12
     N026106   1 3/4 + -2 3/4 = ?   -1

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Mathematics for the Intermediate Division

TOPIC N026000: Adding and Subtracting Rational
Numbers in Fraction Form

OBJECTIVE N026200: Subtracting rationals
(fraction form)

MODEL: $a/b - c/d = ?$
$-5 \leq a,c \leq 5$ $a,c \neq 0$
$-6 \leq b,d \leq 6$ $b,d \neq -1,0,1$
$|a| \leq |b|, \quad |c| \leq |d|$ $b \neq d$

EXAMPLES:

N026201 $1/-3 - 4/-5 \quad = ?$ $7/15$

NO26202 $-2/5 - (-2/-5) = ?$ $-4/5$

N026203 $5/-6 - 1/5 \quad = ?$ $-1\ 1/30$

Mathematics for the Intermediate Division

TOPIC N026000: Adding and Subtracting Rational
Numbers in Fraction Form

OBJECTIVE N026300: Adding and subtracting
rationals (fraction form)

MODEL: a/b + c d/e = ?
$$-5 \leq a \leq 5 \qquad a \neq 0$$
$$-6 \leq b \leq 6 \qquad b \neq -1,0,1$$
$$-2 \leq c \leq 2 \qquad c \neq 0$$
$$1 \leq d \leq 5$$
$$2 \leq e \leq 6 \qquad |b| \neq e$$
$$\qquad\qquad |a| < |b| \qquad d < e$$

EXAMPLES:

NO26301   -3/6 + 1 4/5 = ?   1 3/10

NO26302   4/-5 + 2 3/6 = ?   1 7/10

NO26303   -1/6 + -1 3/5 = ?   -1 23/30

MODEL: c d/e - a/b = ?
$$-2 \leq c \leq 2 \qquad c \neq 0$$
$$1 \leq d \leq 5 \qquad d < e$$
$$2 \leq e \leq 6 \qquad |b| \neq e$$
$$-5 \leq a \leq 5 \qquad a \neq 0 \qquad |a| < |b|$$
$$-6 \leq b \leq 6 \qquad b \neq -1, 0, 1$$

EXAMPLES:

NO26304   -1 4/5 - 4/-6 = ?   -1 2/15

NO26305   -2 1/3 - -5/-6 = ?   - 3 1/6

NO26306   1 2/5 - 3/-4   = ?   2 3/20

N026400 Performance Analysis (Instrument Statistics[1]) for Adding and Subtracting Rational Numbers in Fraction Form

Instrument		Calibration Sample Size	Average Student Response Time (seconds) n=923	P-Value	Discrimination
N026401	$-1/2 + (-2\ 5/6) = ?\ -3\ 1/3$	(225)	79	.14	.55
N026402	$-1\ 5/6 - 1/-5 = ?\ -1\ 19/30$	(354)	70	.21	.53
N026403	$3/-5 + 2\ 4/6 = ?\ 2\ 1/15$	(231)	63	.25	.46
N026404	$2\ 2/6 - (-1/-5) = ?\ 2\ 2/15$	(309)	85	.20	.51
N026405	$3/-4 + 1\ 3/5 = ?\ 17/20$	(175)	69	.07	.37
N026406	$2\ 4/6 - 4/-5 = ?\ 3\ 7/15$	(139)	91	.23	.48
N026407	$4/-6 + 2\ 1/2 = ?\ 1\ 5/6$	(217)	76	.25	.63
N026408	$2\ 5/6 - (-3/-4) = ?\ 2\ 1/12$	(42)	74	.07	.38
		(524)		.3	.6
N026409	$-4/5 + 1\ 3/6 = ?\ 7/10$	(85)	93	.22	.52
N026410	$2\ 2/3 - 2/5 = ?\ 2\ 4/15$	(655)	100	.33	.58
		(371		.57	.51

[1] Statistics are given for each item and for each occurrence of an item on different test versions.

Mathematics for the Intermediate Division

TOPIC N027000: Adding and Subtracting Rationals in Decimal
Form

(a) Reference(s) to the Curriculum Guideline:
Grade 7
Grade 8
Grade 9 Gen   N 4b
Grade 10

(b) Difficulty Level:
pre-instruction = .16, post-instruction = .73

Grade 7	.02	.06
Grade 8	.08	.23
Grade 9	.10	.37
Grade 10	.34	.60

OBJECTIVE N027100: Adding rational numbers (decimal form)

MODEL: $a + b + c + d = ?$
$-9.9 \leq a \leq +5.0$ $\qquad$ $a \neq 0$
$-5.00\overline{0} \leq \overline{b} \leq +5.000$ $\qquad$ $b \neq 0$
$-5.00 \leq \overline{c} < \overline{0}$
$-5 \leq d\overline{\leq} 5$ $\qquad$ $d \neq 0$

EXAMPLES:

N027101 $(-3.4) + (-3) + (-1) + (-3)$ $\qquad$ $= ?$

-10.4

N027102 $(1.7) + (-4.017) + (-4.42) + (2) = ?$

-4.737

N027103 $(-8.2) + (3.486) + (-2.9) + (-4) = ?$

-11.614

MODEL: $a + b + (c) = ?$
$-9.9 \leq a \leq +5.0$ $\qquad$ $a \neq 0$
$-5 \leq \overline{b} \leq \overline{5}$ $\qquad$ $b \neq 0$
$-5.\overline{00} \leq \overline{c} < 0$

OBJECTIVE N027100 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N027000: Adding and Subtracting Rationals in Decimal
Form

EXAMPLES:

N027104	$(-1.8) + (-2) + (-4.2) = ?$	-8
N027105	$(-1.1) + (-1) + (-1.21) = ?$	-3.31
N027106	$(4.6) + (3) + (-3.76) = ?$	3.84

Mathematics for the Intermediate Division

TOPIC N027000: Adding and Subtracting Rationals in Decimal Form

OBJECTIVE N027200: Subtracting rational numbers (decimal form)

MODEL: a - b = ?
            $-5.00 \leq a < 0$
            $0 < b < 5.000$

EXAMPLES:

      N027201   (-0.46) - 1.846 = ?   -2.306

      N027202   (-0.77) - 3.25 = ?   -4.02

      N027203   (-3.92) - 2.061 = ?   -5.981

MODEL: a - b = ?
            $0 < a \leq 5.000$
            $-5.00 \leq b < 0$

EXAMPLES:

      N027204   0.505 - (-4.76) = ?   5.265

      N027205   3.125 - (-1.04) = ?   4.165

      N027206   1.962 - (-0.07) = ?   2.032

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N027000: Adding and Subtracting Rationals in Decimal
Form

OBJECTIVE N027300: Adding and subtracting rational numbers
(decimal form)

MODEL: $a - b - c + d = ?$
$-9.9 \le a \le 5.0$ $a \ne 0$
$-5.00\overline{0} \le \overline{b} \le 5.000$ $b \ne 0$
$-5.00 \le \overline{c} < 0$
$-5 \le \overline{d} \le 5$ $d \ne 0$

EXAMPLES:

N027301 $4.0 - (-2.641) - (-1.44) + 4 = ?$

12.081

N027302 $-2.8 - 1.633 - (-3.07) + (-3) = ?$

-4.363

N027303 $1.5 - (-4.026) - (-1.94) + 2 = ?$

9.466

MODEL: $a - b + c = ?$
$-9.9 \le a \le 5.0$ $a \ne 0$
$-5 \le \overline{b} \le \overline{5}$ $b \ne 0$
$-5.\overline{00} \le \overline{c} < 0$

EXAMPLES:

N027304 $(-0.2) - 3 + (-0.28)$ $= ?$ -3.48
N027305 $4.5 - 2 + (-1.64)$ $= ?$ 0.86
N027306 $(-3.6) - (-4) + (-4.02) = ?$ -3.62

MODEL: $a - b - c = ?$
$-9.9 \le a \le 5$ $a \ne 0$
$-5 \le \overline{b} \le \overline{5}$ $b \ne 0$
$-5.\overline{00} \le \overline{c} < 0$
a,b,c are randomly arranged.

OBJECTIVE N027300 (cont'd)

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Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N027000: Adding and Subtracting Rationals in Decimal
                Form

EXAMPLES:

N027307	(-0.96) - (-9.5) - 5 = ?	3.54
N027308	4.5 - (-2) - (-3.64) = ?	10.14
N027309	3 - (-8.3) - (-1.44) = ?	12.74

Ontario Assessment Instrument Pool

N027400   Performance Analysis (Instrument Statistics[1]) for Adding and Subtracting
Rational Numbers (decimal form)

Instrument		Calibration Sample Size	Average Student Response Time (seconds) n=737	P-Value	Discrimination
N027401	(-2.6) - (-5) + (-2.5) - (-1) = ? 0.9	(225)	77	.06	.34
N027402	(-3.85) - 2 - (-3.5) = ? -2.35	(354)	79	.17	.52
N027403	(-4.51) - (-3) + (-2.5) - 2 = ? -6.01	(85)	78	.25	.65
N027404	3 - 2 + (-4.65) - (-0.8) = ? -2.85	(175)	95	.05	.21
N027405	(-2) - (-4.44) + (-3.4) - 4 = ? -4.96	(655)	85	.07	.41
N027406	(-0.36) - (-7.1) - (-2) + 3 = ? 11.74	(217)	101	.31	.51
N027407	(-1.4) - (-5.5) + 4 - (-5) = ? 13.1	(309)	92	.22	.52
N027408	(-3) - (-2.7) + (-3.1) = ? -3.4	(231)	62	.24	.5
		(71)		.01	.13
N027409	(-1.3) - (-1) + (-3.77) - (-5) = ? 0.93	(139)	65	.16	.45
		(42)		.02	-.01
N027410	(-1.74) - 4 - (-3) + (-1.1) = ? -3.84	(371)	78	.25	.63

[1]Statistics are given for each item and for each occurrence of an item on different test versions.

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Mathematics for the Intermediate Division

TOPIC N028000: Multiplying and Dividing Rational Numbers
in Decimal Form

(a) Reference(s) to the Curriculum Guideline:
Grade 7
Grade 8
Grade 9 Gen   N 4b
Grade 10

(b) Difficulty Level:
pre-instruction = .35, post-instruction = .76

Grade 7	.04	.14
Grade 8	.37	.37
Grade 9	.34	.49
Grade 10	.47	.70

OBJECTIVE N028100:   Multiplying and dividing rationals
(decimal form)

MODEL: a/y = ?
$-9.9999 \leq a \leq -0.0001$
$y \in \{-0.00\overline{1}, -\overline{0}.01, -0.1, 0.1, 0.01, 0.001\}$

EXAMPLES:

N028101 $-9.8356/-0.1$ = ?   98.356

N028102 $-0.4963/-0.001$ = ?   496.3

N028103 $-4.0225/0.01$ = ?   -402.25

MODEL: $a \times b$ = ?
$a = xy$ $y \in \{-0.0001, -0.01, -0.1\}$
$1 \leq x \leq 900$
$b = zv$ $1 \leq z \leq 99$ $v \in \{-0.001, -0.01, 0.1\}$

OBJECTIVE N028100 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N028000: Multiplying and Dividing Rational Numbers
            in Decimal Form

EXAMPLES:

        N028104   -0.009 x -0.2 = ?   0.0018
        N028105   -0.05 x -0.84 = ?   0.042
        N028106   -88.6 x -0.009 = ?   0.7974

MODEL: b/a = ? (Correct to two decimal places)
           b = zv
           $1 \le z \le 999$ $v \in \{-0.001, -0.01, -0.1, 0.1,$
                                      $0.01, 0.001\}$
           a = xy $1 \le x \le 9$
               $y \in \{-0.001, -0.01, -0.1, 0.1$ $0.01, 0.001\}$

EXAMPLES:

        N028107   0.535/0.4   = ?   1.34
        N028108   -0.046/-0.2 = ?   .23
        N028109   -0.743/0.005 = ?   -148.6

N028200 Performance Analysis (Instrument statistics[1]) for Multiplying and Dividing Rationals (decimal form)

Instrument		Calibration Sample Size	Average Student Response Time (seconds) n=581	P-Value	Discrimination
N028201	$5.24 \times (-0.11) = ? \quad -0.5764$	(231)	78	.41	.52
N028202	$-1.3972 \div -0.01 = ? \quad 139.72$	(175)	75	.3	.35
		(524)		.48	.66
N028203	$-0.1 \times -0.67 = ? \quad 0.067$	(309)	64	.4	.55
		(354)		.39	.59
N028204	$-0.0201 \div 0.004$ (correct to two decimal places) $= ? \quad 5.03$	(225)	45	.06	.25
N028205	$2.77 \times -0.43 = ? \quad 1.1911$	(217)	55	.31	.51
N028206	$-0.866 \div 1.1$ (correct to two decimal places) $= ? \quad -0.79$	(76)	71	.00	–
N028207	$-557.14 \times -0.1 = ? \quad 55.714$	(655)	99	.32	.63
N028208	$-2.5157 \div 0.01$ (correct to two decimal places) $= ? \quad -251.57$	(42)	46	.17	.59
N028209	$-0.4 \times -1 = ? \quad 0.4$	(85)	58	.42	.69
		(371)		.62	.59
N028210	$-0.0693 \div 0.03$ (correct to two decimal places) $= ? \quad -2.31$	(139)	45	.33	.47

[1] Statistics are given for each item and for each occurrence of an item on different test versions.

Mathematics for the Intermediate Division

TOPIC N029000: Applications

OBJECTIVE N029100: Simple addition and subtraction
problems

MODEL: [Name] baked x cookies but her [brother,
sister] ate y of them. How many cookies are left?
Name = [Sue, Dot, Doreen]

$25 \leq x \leq 50$
$3 \leq y \leq 10$

EXAMPLES:

N029101   Sue baked 25 cookies but her brother
ate 4 of them. How many are left? 21

N029102   Doreen baked 48 cookies but her sister
ate 9 of them. How many are left? 39

N029103   Dot baked 32 cookies but her sister
ate 5 of them. How many are left? 27

MODEL: [Name] is x years old. If Jan is y years
younger, how old is Jan?
Name = [Rod, Ned, Kim]

$10 \leq x \leq 25$
$2 \leq y \leq 9$

EXAMPLES:

N029104   Kim is 25 years old. If Jan is 7
years younger, how old is Jan? 18

N029105   Rod is 16 years old. If Jan is 9
years younger, how old is Jan? 7

N029106   Ned is 22 years old. If Jan is 6
years younger, how old is Jan? 16

OBJECTIVE N029100 (cont'd)

Mathematics for the Intermediate Division

TOPIC N029000: Applications

MODEL: [Name] must sell x boxes of candy. If his
brother sells y of them, how many are left for
[name] to sell?

Name = [Ted, Don, Dan]

$15 \leq x \leq 30$

$5 \leq y \leq x$

EXAMPLES:

N029107 Dan must sell 18 boxes of candy. If his
brother sells 7 of them, how many are
left for Dan to sell?   11

N029108 Ted must sell 28 boxes of candy. If his
brother sells 19 of them, how many are
left for Ted to sell?   9

N029109 Ted must sell 17 boxes of candy. If his
brother sells 11 of them, how many are
left for Ted to sell?   6

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N029000: Applications

OBJECTIVE N029200:   Simple multiplication and division
                     problems

MODEL: A player scores x points in y games. What is
            her average number of points per game?

            $3 \leq y \leq 9,$ $5 \leq z \leq 15,$ $x = yz$

EXAMPLES:

            N029201   A player scores 32 points in 4 games.
                       What is her average number of points
                       per game?   8

            N029202   A player scores 90 points in 5 games.
                       What is her average number of points per
                       game?   18

            N029203   A player scores 78 points in 6 games.
                       What is her average number of points
                       per game?   13

MODEL: x people are sharing equally a bucket of chicken.
            If there are y pieces of chicken in the bucket,
            how many will each person get?

                 $5 \leq x \leq 12$ $y = xz$ $2 \leq z \leq 5$

OBJECTIVE N029200 (cont'd)

Mathematics for the Intermediate Division

TOPIC N029000: Applications

EXAMPLES:

N029204   11 people are sharing equally a bucket
of chicken. If there are 33 pieces of
chicken in the bucket, how many will
each person get?   3

N029205   7 people are sharing equally a bucket
of chicken. If there are 28 pieces of
chicken in the bucket, how many will
each person get?   4

N029206   4 people are sharing equally a bucket of
chicken. If there are 16 pieces of
chicken in the bucket, how many will
each person get?   4

MODEL: Some children are choosing teams. They need
x teams with y players per team. How many can
play all together?

$$2 \leq x, y \leq 5$$

EXAMPLES:

N029207   Some children are choosing teams. They
need 3 teams with 5 players per team.
How many can play all together?   15

N029208   Some children are choosing teams. They
need 5 teams with 4 players per team.
How many can play all together?   20

N029209   Some children are choosing teams. They
need 4 teams with 3 players per team.
How many can play all together?   12

Mathematics for the Intermediate Division

TOPIC N029000: Applications

OBJECTIVE N029300:   Simple problem with whole numbers

MODEL: [Name] can pack x tennis balls in a can. How
            many cans will he fill with y tennis balls?

            Name = [Ned, Jed, Ted]

                $3 \leq x \leq 6$ $y = xz$

                $2 \leq z \leq 5$

EXAMPLES:

            N029301   Jed can pack 6 tennis balls in a can.
                       How many cans will he fill with 30 tennis
                       balls?   5

            N029302   Ned can pack 3 tennis balls in a can. How
                       many cans will he fill with 12 tennis
                       balls?   4

            N029303   Ted can pack 4 tennis balls in a can.
                       How many cans will he fill with 16 tennis
                       balls?   4

MODEL: [Name] got a ticket for driving x km/h over the
            speed limit. The limit was y km/h. What was her
            speed?

            Name = [Connie, Karen, Margaret]

                $5 \leq x \leq 15$

                $10 \leq z \leq 20$

                $y = 5z$

OBJECTIVE N029300 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N029000: Applications

EXAMPLES:

N029304   Karen got a ticket for driving 13 km/h
           over the speed limit. The limit was
           90 km/h. What was her speed? 103 km/h

N029305   Margaret got a ticket for driving 15 km/h
           over the speed limit. The limit was 100
           km/h. What was her speed?   115 km/h

N029306   Connie got a ticket for driving 11 km/h
           over the speed limit. The limit was 40
           km/h. What was her speed?   51 km/h

MODEL: Farmer [name] is buying shoes for his x horses.
           Each horse needs 4 shoes. How many horseshoes
           should he buy altogether?

           Name = [Brown, Fritz, Davis]

               $3 \leq x \leq 12$

EXAMPLES:

N029307   Farmer Brown is buying shoes for his
           8 horses. Each horse needs 4 shoes.
           How many horseshoes should he buy
           altogether?   32

N029308   Farmer Davis is buying shoes for his 12
           horses. Each horse needs 4 shoes. How
           many horseshoes should he buy altogether
                              48

N029309   Farmer Fritz is buying shoes for his 3
           horses. Each horse needs 4 shoes. How
           many horseshoes should he buy altogether
                              12

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N029000: Applications

OBJECTIVE N029400: Problems requiring a single operation

MODEL: A group of [boys, girls] is going on an x-day
            camping trip. They know from their last trip
            that all together they eat y slices of bread and
            z cans of beans each day. How many cans of
            beans should they take this time?

            $3 \leq x,z \leq 7$

            $8 \leq y \leq 10$

EXAMPLES:

N029401   A group of girls is going on a four day
            camping trip. They know from their last
            trip that all together they eat 9 slices
            of bread and 5 cans of beans each day.
            How many cans of beans should they take
            this time?   20

N029402   A group of boys is going on a 7 day
            camping trip. They know from their last
            trip that all together they eat 10 slices
            of bread and 3 cans of beans each day.
            How many cans of beans should they take
            this time?   21

N029403   A group of boys is going on a 3 day
            camping trip. They know from their last
            trip that all together they eat 8 slices
            of bread and 6 cans of beans each day.
            How many cans of beans should they take
            this time?   18

OBJECTIVE N029400 (cont'd)

Mathematics for the Intermediate Division

TOPIC N029000: Applications

MODEL: [Name] receives $x for watering her neighbour's
plants. She counts y plants in the living room,
z plants in the kitchen and w on the porch.
How many plants will [name] be taking care of?

Name = [Jane, Nancy, Ellen]

$2 \leq x \leq 10$ $2 \leq y,z,w,w \leq 6$

EXAMPLES:

N029404   Ellen receives $8 for watering her
neighbour's plants. She counts 3 in the
living room, 5 in the kitchen and
5 on the porch. How
many plants will Ellen be caring
for? 13

N029405   Jane receives $10 for watering her
neighbour's plants. She counts 4
in the living room, 4 in the kitchen
and 3 on the porch. How many plants
will Jane be caring for? 11

N029406   Jane receives $3 for watering her
neighbour's plants. She counts 2 in
the living room, 5 in the kitchen and
6 on the porch. How many plants will
Jane be caring for? 13

OBJECTIVE N029400 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N029000: Applications

MODEL: [Name] jogs x days every week. One day he
          ran y km before breakfast and z km after school.
          How many kilometres did he run that day?

          Name = [Tony, Gordon, Allan]

          $3 \leq x \leq 5$

          $5 \leq y,z \leq 10$

EXAMPLES:

    N029407   Tony jogs 5 days a week. One day he ran
               7 km before breakfast and 9 km after
               school. How many kilometres did he run
               that day?   16 km

    N029408   Allan jogs 3 days a week. One day
               he ran 4 km before breakfast and 8 km
               after school. How many kilometres did
               he run that day?   12 km

    N029409   Gordon jogs 4 days a week. One day
               he ran 6 km before breakfast and 9 km
               after school. How many kilometres did
               he run that day?   15 km

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N029000: Applications

OBJECTIVE N029500: Problems requiring multiple operations

MODEL: [Name] is dieting. For dinner she had p grams of
            beef, q grams of cheese and one W. Her calorie
            book lists beef as 5 calories per gram; cheese is
            3 calories per gram and the W is m calories.
            How many calories were in her dinner?

            Name = [Mary, Pat, Carol]

            $6 \leq x \leq 9$ p = 10x

            $3 \leq y \leq 9$ q = 10y

            W = [bagel, banana, muffin]

            $50 \leq m \leq 200$

OBJECTIVE N029500 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N029000: Applications

EXAMPLES:

N029501   Mary is dieting. For dinner she had
50g of beef, 70g of cheese and one banana.
Her calorie book lists beef as 5 calories
per gram; cheese is 3 calories per gram
and the banana is 90 calories. How many
calories were in her dinner?   550

N029502   Pat is dieting. For dinner she had 70g
of beef; 40g of cheese and one muffin.
Her calorie book lists beef as 5 calories
per gram; cheese is 3 calories per gram
and the muffin is 130 calories. How many
calories were in her dinner?   600

N029503   Carol is dieting. For dinner she had 90g
of beef; 60g of cheese and one bagel.
Her calorie book lists beef as 5 calories
per gram; cheese is 3 calories per gram
and the bagel is 150 calories. How many
calories were in her dinner?   780

OBJECTIVE N029500 (cont'd)

Mathematics for the Intermediate Division

TOPIC N029000: Applications

MODEL: [Name] wants to buy a bicycle that costs $m
          but he has only $z saved. How many weeks will
          it take him to save the rest of the money,
          if every week he saves $x from the money he
          earns on his paper route?

          Name = [Ian, David, Shawn]

          $5 \le x \le 10$

          $3 \le y \le 9$

          $12 \le z \le 25$

          $m = xy + z$

OBJECTIVE N029500 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N029000: Applications

EXAMPLES:

N029504   Shawn wants to buy a bicycle that costs $100 but he has only $20 saved. How many weeks will it take him to save the rest of the money, if every week he saves $10 from the money he earns on his paper route?   8 weeks

N029505   Ian wants to buy a bicycle that costs $95 but he has only $23 saved. How many weeks will it take him to save the rest of the money, if every week he saves $8 from the money he earns on his paper route?   9 weeks

N029506   David wants to buy a bicycle that costs $63 but he has only $15 saved. How many weeks will it take him to save the rest of the money if every week he saves $6 from the money he earns on his paper route?   8 weeks

OBJECTIVE N029500 (cont'd)

Mathematics for the Intermediate Division

TOPIC N029000: Applications

MODEL: Mr. [Name] is interested in joining a [x] club.
The joining fee is $p and the dues are $q
per month. He must also pay a locker fee of
$30 per year. What would it cost him to
join the club for one year?

Name = [Sands, Waters, Courtney]

x = [tennis, golf, sailing]

$1 \leq y \leq 4$ $p = 100\ y$

$1 \leq z \leq 3$ $q = 10z$

OBJECTIVE N029500 (cont'd)

Mathematics for the Intermediate Division

TOPIC N029000: Applications

EXAMPLES:

N029507   Mr. Courtney is interested in joining a golf club. The joining fee is $400 and the dues are $20 per month. He must also pay a locker fee of $30 per year. What would it cost him to join the club for one year? $670

N029508   Mr. Waters is interested in joining a tennis club. The joining fee is $300 and the dues are $10 per month. He must also pay a locker fee of $30 per year. What would it cost him to join the club for one year? $450

N029509   Mr. Sands is interested in joining a sailing club. The joining fee is $200 and the dues are $30 per month. He must also pay a locker fee of $30 per year. What would it cost him to join the club for one year? $590.

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N029000: Applications

OBJECTIVE N029600: Problems using decimals

MODEL: [Name] has $x in her savings account. She
            deposits $y more. How much does she have in
            her savings account now?

            Name = [Julia, Cindy, Molly]

                 50.10 $\leq$ x $\leq$ 75.99

                 10.01 $\leq$ y $\leq$ 20.99

EXAMPLES:

        N029601   Julia has $72.65 in her savings account.
                   She deposits $17.45 more. How much does
                   she have in her savings account now?
                   $90.10
        N029602   Molly has $55.82 in her savings account.
                   She deposits $14.42 more. How much does
                   she have in her savings account now?
                   $70.24
        N029603   Cindy has $74.88 in her savings account.
                   She deposits $20.99 more. How much does
                   she have in her savings account now?
                   $95.87

MODEL: [Name] has $x. If gas is $0.25 per litre, how
            many litres of gas can he buy?

            Name = [Eddie, John, Peter]

                  3.00 $\leq$ x $\leq$ 8.00

OBJECTIVE N029600 (cont'd)

Mathematics for the Intermediate Division

TOPIC N029000: Applications

EXAMPLES:

N029604   Peter has $4.75. If gas is $0.25 per litre, how many litres of gas can he buy?   19

N029605   John has $8.00. If gas is $0.25 per litre how many litres of gas can he buy?   32

N029606   Eddie has $5.25. If gas is $0.25 per litre how many litres of gas can he buy?   21

MODEL: [Name] buys x litres of gas at $.025 per litre. What is her total bill for gas (in dollars)?

Name = [Lana, Heather, Roberta]

$10 \leq y \leq 20$

$x = y + 0.4$

EXAMPLES:

N029607   Heather buys 16.4 litres of gas at $0.25 per litre. What is her total bill for gas (in dollars)? $4.10

N029608   Lana buys 20.4 litres of gas at $0.25 per litre. What is her total bill for gas (in dollars)? $5.10

N029608   Roberta buys 13.4 litres of gas at $0.25 per litre. What is her total bill for gas (in dollars)? $3.35

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N029000: Applications

OBJECTIVE N029700: Problems using fractions

MODEL: A certain motion needs the votes of 2/3 of the committee to pass. If there are y people on the committee, how many votes are needed to pass the motion?

   2 ≤ x ≤ 6   y = 3x

EXAMPLES:

   N029701   A certain motion needs the votes of 2/3 of the committee to pass. If there are 18 people on the committee, how many votes are needed to pass the motion?
              12

   N029702   A certain motion needs te votes of 2/3 of the committee to pass. If there are 9 peop on the committee, how many votes are neede to pass the motion?
              6

   N029703   A certain motion needs the votes of 2/3 of the committee to pass. If there are 15 people on the committee, how many votes are needed to pass the motion?
              10

OBJECTIVE N029700 (cont'd)

Mathematics for the Intermediate Division

TOPIC N029000: Applications

MODEL: A gas tank holds y litres of gasoline. If the
           tank is z full, how many litres of gas does
           it contain?

           $4 \leq x \leq 6$ $y = 12x$ $z \{1/3, 1/4, 1/2, 2/3, 3/4\}$

EXAMPLES:

           N029704   A gas tank holds 60 litres of gasoline.
                      If the tank is 2/3 full, how many litres
                      of gas does it contain?
                      40

           N029705   A gas tank holds 48 litres of gasoline.
                      If the tank is 3/4 full, how many litres
                      of gas does it contain?
                      36

           N029706   A gas tank holds 72 litres of gasoline.
                      If the tank is 1/3 full, how many litres
                      of gas does it contain?
                      24

OBJECTIVE N029700 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N029000: Applications

MODEL: On Sunday a long distance call costs only 1/3
           of the regular rate. If the regular charge for
           a call is $y how much will it cost on a Sunday?

           $1 \leq x \leq 4$ $y = 3x$

EXAMPLES:

           N029707   On Sunday a long distance call costs only
                       1/3 of the regular rate. If the regular
                       charge for a call is $9.00, how much will
                       it cost on a Sunday? $3.00
           N029708   On Sunday a long distance call costs only
                       1/3 of the regular rate. If the regular
                       charge for a call is $12.00, how much will
                       it cost on a Sunday? $4.00
           N029709   On Sunday a long distance call costs only
                       1/3 of the regular rate. If the regular
                       charge for a call is $6.00, how much will
                       it cost on a Sunday? $2.00

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N029000: Applications

OBJECTIVE N029800: Estimating

MODEL: If gas costs x cents per litre, how many litres
            of gas will $y buy? Which is the best estimate
            of the final answer?

            a. p   b. y   c. w   d. t

            Answer a, b, c, or d.

            p = y/2   w = 5y   t = 20y

            $20.1 \leq x \leq 20.9$ $3 \leq y \leq 6$

EXAMPLES:

        N029801   If gas costs 20.9 cents per litre, how
                    many litres of gas will $3.00 buy? Which
                    is the best estimate of the final answer?
                    a. 1.5   b. 3   c. 15   d. 60
                    Answer a,b,c, or d   c
        N029802   If gas costs 20.3 cents per litre, how
                    many litres of gas will $6.00 buy? Which
                    is the best estimate of the final answer?
                    a. 3   b. 6   c. 30   d. 120
                    Answer a,b,c or d   c
        N029803   If gas costs 20.7 cents per litre, how
                    many litres of gas will $5.00 buy? Which
                    is the best estimate of the final answer?
                    a. 2.5   b. 5   c. 25   d. 100
                    Answer a, b, c, or d   c

OBJECTIVE N029800 (cont'd)

Mathematics for the Intermediate Division

TOPIC N029000: Applications

MODEL: [Name] is given a list of people to call. He
           takes y hours to call 2/3 of the people on his
           list. At that rate, how much longer will it
           take him to call the rest of the people on his
           list? Which is the best estimate of the final
           answer?

    a.   about x hours

    b.   about y hours

    c.   more than y hours but less than z hours.

Answer a, b, or c.

Name = [Henry, George, Vern]

    y {1 1/4, 1 1/2, 1 3/4}

    x = 1/2 y

    z = 2y

EXAMPLES:

    N029804   Vern is given a list of people to call.
    He takes 1 3/4 hours to call 2/3 of the
    people on his list. At that rate, how
    much longer will it take him to call the
    rest of the people on his list? Which
    is the best estimate of the final answer?
    a.   about 7/8 of an hour
    b.   about 1 3/4 hours
    c.   more than 1 3/4 hours but less than
    3 1/2 hours
    Answer a, b or c   a

OBJECTIVE N029800 (cont'd)

Mathematics for the Intermediate Division

TOPIC N029000: Applications

EXAMPLES:

N029805   Henry is given a list of people to call. He takes 1 1/4 hours to call 2/3 of the people on his list. At that rate, how much longer will it take him to call the rest of the people on the list? Which is the best estimate of the final answer?

a.   about 5/8 hours

b.   about 1 1/4 hours

c.   more than 1 1/4 hours but less than 2 1/2 hours.

Answer a, b, or c   a

N029806   George is given a list of people to call. He takes 1 3/4 hours to call 2/3 of the people on his list. At that rate, how much longer will it take him to call the rest of the people on the list? Which is the best estimate of the final answer?

a.   about 7/8 hours

b.   about 1 3/4 hours

c.   more than 1 3/4 hours but less than 3 1/2 hours

Answer a, b, or c   a

OBJECTIVE N029800 (cont'd)

Mathematics for the Intermediate Division

TOPIC N029000: Applications

MODEL: [Name] is competing in a skating event and
           receives the following scores from the six
           judges:

               a   b   c   d   e   f

           Which is the best estimate of the total
           score given by the judges?
           Answer a, b, c or d
           Name = [Stan, Dave, Mike]

           4.7 ≤ a, b, c, d, e, f ≤ 5.2

OBJECTIVE N029800 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N029000: Applications

EXAMPLES:

N029807   Stan is competing in a skating event and
           receives the following scores from the
           six judges:
           5.1 4.7 4.7 5.0 4.8 4.7
           Which is the best estimate of the total
           score given by the judges?
           Answer a, b, c, or d
           a. 5   b. 24,   c. 30   d. 36   c

N029808   Mike is competing in a skating
           event and receives the following
           scores from the six judges:
           5.0   4.7   4.8   4.8   5.0   4.7
           Which is the best estimate of the
           total score given by the judges?
           Answer a, b, c, or d
           a. 5   b. 24   c. 30   d. 36   c

N029809   Dave is competing in a skating
           event and receives the following
           scores from the six judges:
           5.2   5.2   5.0   4.7   5.1   5.1
           Which is the best estimate of the
           total score given by the judges?
           Answer a, b, c, or d
           a. 5   b. 24   c. 30   d. 36 c

Mathematics for the Intermediate Division

TOPIC N029000: Applications

OBJECTIVE N029900: Problems involving multiple operations
                    with fractions and decimals

MODEL: [Name] works in a clothing store and receives a
            discount of 1/4 off anything he buys there. If
            he buys a shirt and tie and pays $y for them,
            how much would a regular customer pay for them?

            Name = [Jim, Jerry, Doug]

            8 ≤ x ≤ 15   y = 3x

EXAMPLES:

            N029901   Jim works in a clothing store and
                       receives a discount of 1/4 off anything
                       he buys there. If he buys a shirt
                       and tie and pays $36 for them, how
                       much would a regular customer pay for
                       them? $48.00

            N029902   Doug works in a clothing store and
                       receives a discount of 1/4 off
                       anything he buys there. If he buys
                       a shirt and tie and pays $24 for them,
                       how much would a regular customer
                       pay for them? $32.00

            N029903   Jerry works in a clothing store and
                       receives a discount of 1/4 off
                       anything he buys there. If he buys
                       a shirt and tie and pays $45 for
                       them, how much would a regular customer
                       pay for them? $60.00

OBJECTIVE N029900 (cont'd)

Mathematics for the Intermediate Division

TOPIC N029000: Applications

MODEL: [Name] looks at her gas gauge and notices
           that she has about x of a tank. She can't
           remember how much her tank holds, but she
           stops anyway and fills up with y litres of
           gas. For future reference, about how many
           litres does her gas tank hold? (to the
           nearest litre)

           Name = [Cheryl, Muriel, Denise]

           x {1/4, 1/3, 2/3, 3/4}

           $3 \leq z \leq 16$ y = (12z) x (1-x) one decimal place

OBJECTIVE N029900 (cont'd)

Mathematics for the Intermediate Division

TOPIC N029000: Applications

EXAMPLES:

N029904   Muriel looks at her gas gauge and
          notices that she has about 1/3
          of a tank. She can't remember
          how much her tank holds, but she
          stops anyway and fills up with
          48 litres of gas. For future
          reference, about how many litres does
          her gas tank hold? (to the nearest
          litre)   72 litres

N029905   Cheryl looks at her gas gauge
          and notices that she has about
          1/4 of a tank. She can't remember
          how much her tank holds, but she
          stops anyway and fills up with
          63 litres of gas. For future
          reference, about how many litres
          does her gas tank hold? (to
          the nearest litre)   84 litres

N029906   Denise looks at her gas gauge
          and notices that she has about 2/3
          of a tank. She can't remember
          how much her tank holds, but she
          stops anyway and fills up with
          36 litres of gas. For future
          reference, about how many litres
          does her gas tank hold? (to the
          nearest litre)   108 litres

OBJECTIVE N029900 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N029000: Applications

MODEL: It usually takes [Name] about x minutes to drive
           home from work. While sitting in a traffic jam
           one evening, she notices that after y minutes,
           she is only about z of the way home. If she
           keeps up at that rate, how long will the
           entire trip home take (to the nearest minute)?

           Name = [Marianne, Beth, Joan]

           $19 \leq x \leq 25$

           $x-1 \leq y \leq x +5$

           $z = [2/3, 3/4]$

OBJECTIVE N029900 (con'd)

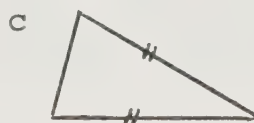Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N029000: Applications

EXAMPLES:

N029907   It usually takes Marianne about 22 minutes to drive home from work. While sitting in a traffic jam one evening, she notices that after 27 minutes, she is only about 3/4 of the way home. If she keeps up at that rate, how long will the entire trip home take (to the nearest minute)?   36 minutes

N029908   It usually takes Beth about 24 minutes to drive home from work. While sitting in a traffic jam one evening, she notices that after 24 minutes she is only about 2/3 of the way home. If she keeps up at that rate, how long will the entire trip home take (to the nearest minute)?
                    36 minutes

N029909   It usually takes Joan about 20 minutes to drive home from work. While sitting in a traffic jam one evening, she notices that after 19 minutes, she is only about 3/4 of the way home. If she keeps up at that rate, how long will the entire trip home take (to the nearest minute)?
                    25 minutes
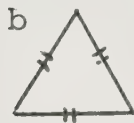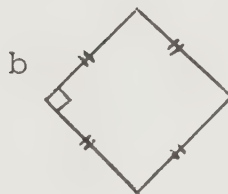
Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division
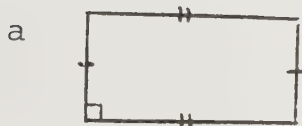
TOPIC N030000: Measurement of Plane Shapes

(a) Reference(s) to the Curriculum Guideline:
     Grade 7   N 8a
     Grade 8   N 6a
     Grade 9   Basic N 9b
              Mod   N 8a (Courses A,B)
     Grade 10 Mod   N 8a (Course C)

(b) Difficulty Level:
     pre-instruction = .76, post-instruction = .90

OBJECTIVE N030100: Identifying shapes

MODEL: In this figure [description of figure] choose
           from parallelogram, rectangle, rhombus, trapezoid,
           triangle. The name of this figure is?

EXAMPLES:

           N030101   In this figure one pair of opposite sides
                      is parallel.
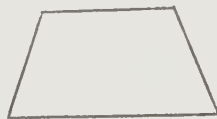
           The name of this figure is?   trapezoid

           N030102   In this figure there are three sides:

           The name of this figure is?   triangle

OBJECTIVE N030100 (cont'd)

Mathematics for the Intermediate Division

TOPIC N030000: Measurement of Plane Shapes

EXAMPLES:

N030103   In this figure, both pairs of opposite sides are parallel and one angle is a right angle.
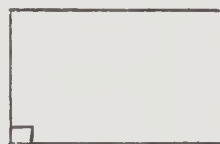
The name of this figure is?   rectangle

MODEL: Which of the following figures is a [figure]? Write the letter.
Figure = [scalene triangle, isosceles triangle, equilateral triangle, square, parallelogram, rhombus].

Include diagrams of the correct figure and two others from the list.

EXAMPLES:

N030104   Which of the following figures is a parallelogram?

a   b   c
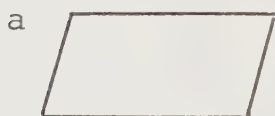
Write the letter - a

OBJECTIVE N030100 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

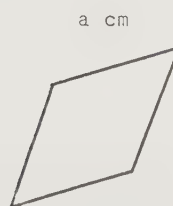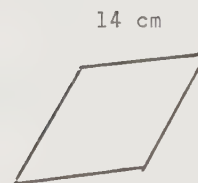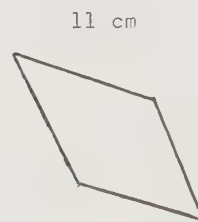TOPIC N030000: Measurement of Plane Shapes

EXAMPLES:

N030105   Which of the following figures is an isosceles triangle?

Write the letter - c

N030106   Which of the following figures is a square?

Write the letter - b

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N030000: Measurement of Plane Shapes

(a) Reference(s) to the Curriculum Guideline:
     Grade 7   N 8a
     Grade 8   N 6a
     Grade 9   Basic N 9b
               Mod   N 8a (Courses A,B)
     Grade 10 Mod   N 8a (Course C)

(b) Difficulty Level:
     pre-instruction = .71, post-instruction = .92

OBJECTIVE N030200: Finding perimeters

MODEL:

b cm

a cm

$5 \leq a,b \leq 20$
$a \neq b$

The perimeter of this rectangle is ?

EXAMPLES:
          N030201

16 cm

8 cm
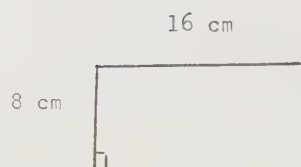
The perimeter of this rectangle is? 48 cm
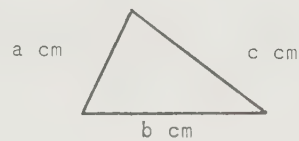
OBJECTIVE N030200 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>
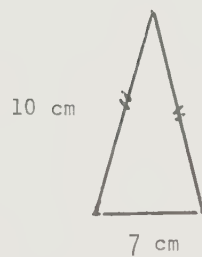
TOPIC N030000: Measurement of Plane Shapes

EXAMPLES:

N030202

6 cm

15 cm

The perimeter of this rectangle is? 42 cm

N030203

19 cm

8 cm
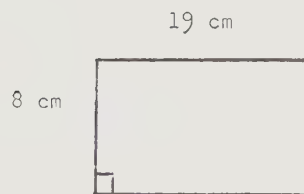
The perimeter of this rectangle is? 54 cm

MODEL:

a cm

$5 \leq a \leq 20$

The perimeter of this rhombus is?

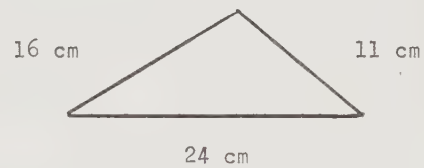OBJECTIVE N030200 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N030000: Measurement of Plane Shapes

EXAMPLES:

N030204

8 cm

The perimeter of this rhombus is? 32 cm

N030205

14 cm

The perimeter of this rhombus is? 56 cm

N030206

11 cm

The perimeter of this rhombus is?   44 cm

OBJECTIVE N030200 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC N030000: Measurement of Plane Shapes

MODEL:

$6 \leq a, b, c \leq 25$
$a + b > c$

The perimeter of this triangle is?

EXAMPLES:

N030207

The perimeter of this triangle is? 27 cm

N030208

The perimeter of this triangle is? 24 cm

OBJECTIVE N030200 (cont'd)

Mathematics for the Intermediate Division

TOPIC N030000: Measurement of Plane Shapes

EXAMPLES:

N030209

The perimeter of this triangle is? 51 cm

MODEL: What is the perimeter of a square with one side x cm
           $1 \leq x \leq 20$

EXAMPLES:

N030210   What is the perimeter of a square with
            one side 19 cm?   76 cm

N030211   What is the perimeter of a square with
            one side 13 cm?   52 cm

N030212   What is the perimeter of a square with
            one side 7 cm?   28 cm

OBJECTIVE N030200 (cont'd)

Mathematics for the Intermediate Division

TOPIC N030000: Measurement of Plane Shapes

MODEL: What is the perimeter of a parallelogram
           with one side x cm in length and another
           side y cm in length?

           $1 \leq x,y \leq 20$ $x \neq y$

EXAMPLES:

         N030213   What is the perimeter of a parallelogram
                     with one side 16 cm in length and another
                     side 15 cm in length?   62 cm

         N030214   What is the perimeter of a parallelogram
                     with one side 19 cm in length and another
                     side 3 cm in length?   44 cm

         N030215   What is the perimeter of a parallelogram
                     with one side 9 cm in length and another
                     side 17 cm in length?   52 cm

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC N030000: Measurement of Plane Shapes

(a) Reference(s) to the Curriculum Guideline:
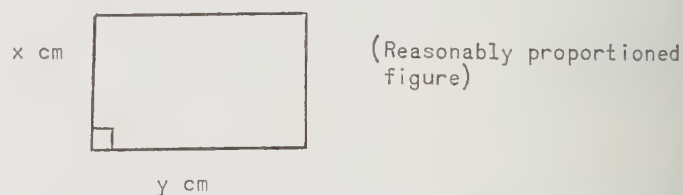   Grade 7   N 8d
     Grade 8   N 6a
     Grade 9 Basic N 9c
              Mod   N 8c (Courses A,B)
     Grade 10 Mod   N 8b (Course C)

(b) Difficulty Level:
     pre-instruction = .29, post-instruction = .95

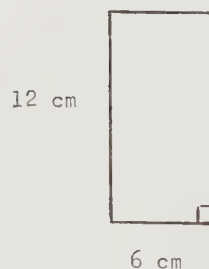OBJECTIVE N030300: Calculating the area of rectangles

MODEL:

x cm   [rectangle]   (Reasonably proportioned figure)

y cm

What is the area of this rectangle (base of y cm and height of x cm)?

$$2 \leq x, y \leq 12$$
$$x \neq y$$

EXAMPLES:
        N030301

12 cm   [rectangle]

6 cm

What is the area of this rectangle

(base of 6 cm and height of 12 cm)?
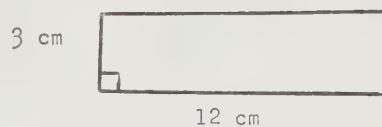
72 cm^2

OBJECTIVE N030300 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>
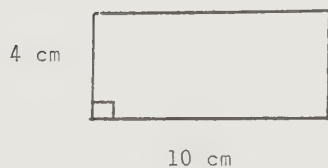
TOPIC N030000: Measurement of Plane Shapes

EXAMPLES:

N030302

3 cm

12 cm

What is the area of this rectangle
(base of 12 cm and height of 3 cm)?
36 cm^2

N030303

4 cm

10 cm

What is the area of this rectangle
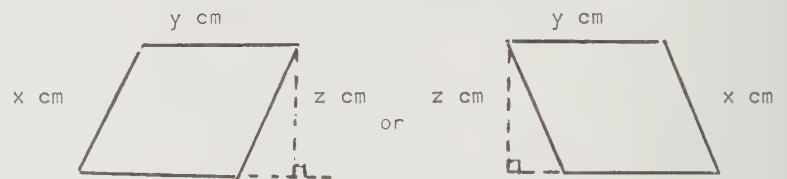(base of 10 cm and height of 4 cm)?
40 cm^2

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Mathematics for the Intermediate Division

TOPIC N030000: Measurement of Plane Shapes

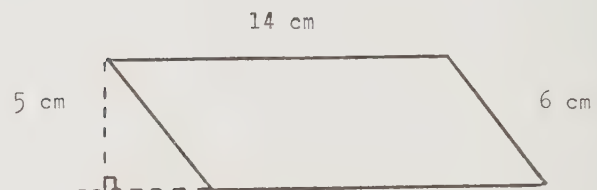OBJECTIVE N030400: Calculating the area of parallelograms

MODEL:

What is the area of this parallelogram (sides of x cm and y cm and height of z cm)?

$$3 \leq x,y \leq 20$$
$$x \neq y$$
$$1 \leq z < x$$

EXAMPLES:

N030401

What is the area of this parallelogram (sides of 6 cm and 14 cm and height of 5 cm)? 70 cm^2
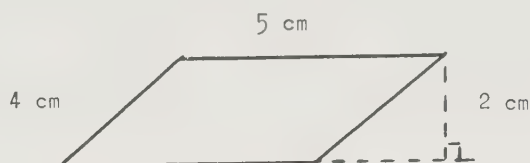
OBJECTIVE N030400 (cont'd)

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<u>Mathematics for the Intermediate Division</u>

TOPIC N030000: Measurement of Plane Shapes

EXAMPLES:

N030402

5 cm

4 cm

2 cm

What is the area of this parallellogram
(sides of 4 cm and 5 cm and height of
2 cm)?   10 cm^2

N030403

12 cm

4 cm

5 cm

What is the area of this parallelogram
(sides 5 cm and 12 cm and height of
4 cm)?   48 cm^2

Mathematics for the Intermediate Division

TOPIC N030000: Measurement of Plane Shapes

OBJECTIVE N030500: Calculating the area of triangles

MODEL:

What is the area of this triangle
(sides of x cm, y cm, and z cm and
height of w cm)?

$$2 \leq a,b \leq 10$$
$$z = a + b$$
$$2 \leq w \leq 10$$
$$x = \text{the square root of } (w^2 + a^2) \text{ to}$$
one decimal place
$$y = \text{the square root of } (w^2 + b^2) \text{ to}$$
one decimal place

EXAMPLES:
N030501
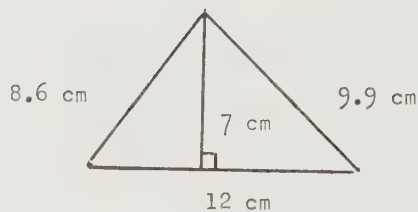
What is the area of this triangle
(sides of 8.6 cm, 9.9 cm and 12 cm
and height of 7 cm)?   42 cm^2

OBJECTIVE N030500 (cont'd)

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Mathematics for the Intermediate Division
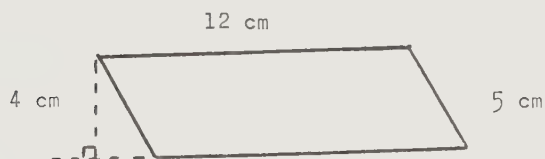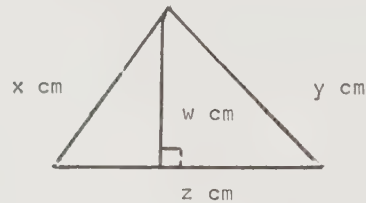
TOPIC N030000: Measurement of Plane Shapes

EXAMPLES:
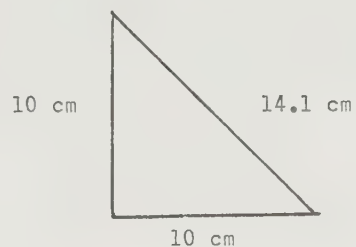
N030502

What is the area of this triangle
(sides of 10 cm, 14.1 cm and 10 cm
and height of 10 cm)?   50 cm^2

N030503
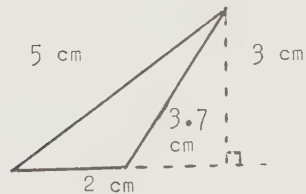
What is the area of this triangle
(sides of 5 cm, 3.7 cm and 2 cm
and height of 3 cm)?   3 cm^2

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Mathematics for the Intermediate Division

TOPIC N030000: Measurement of Plane Shapes

(a) Reference(s) to the Curriculum Guideline:
     Grade 7   N 8a
     Grade 8   N 6a
     Grade 9   Basic N 9b
             Mod   N 8b (Courses A,B)
     Grade 10 Mod   N 8a (Course C)

(b) Difficulty Level:
     pre-instruction = .10, post-instruction = .88

OBJECTIVE N030600: Calculating the perimeter of a trapezoid

MODEL:
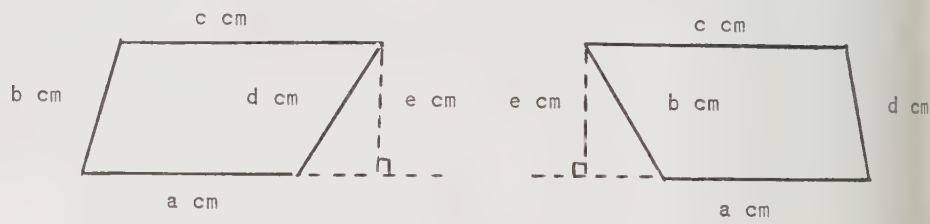
The perimeter of a trapezoid with sides
a cm, b cm, c cm, and d cm is?

$$2 \leq a,b,c,d \leq 10$$
$$a \neq b \neq c \neq d \quad \text{and } e < d, \ e < b$$

EXAMPLES:
         N030601
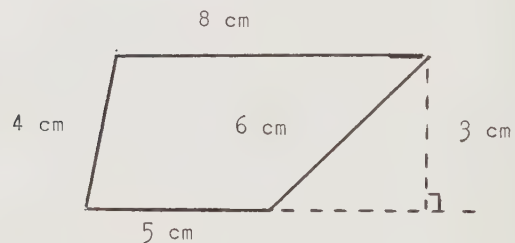
The perimeter of a trapezoid with sides
8 cm, 4 cm, 5 cm, and 6 cm is?   23 cm

OBJECTIVE N030600 (cont'd)

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Mathematics for the Intermediate Division

TOPIC N030000: Measurement of Plane Shapes

EXAMPLES:

N030602

6 cm

5 cm   8 cm   4 cm

4 cm
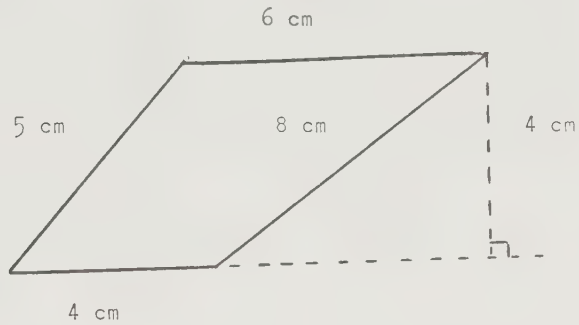
The perimeter of a trapezoid with sides
6 cm, 5 cm, 4 cm, and 8 cm is?   23 cm

N030603

10 cm

4 cm   5 cm   3 cm

7 cm

The perimeter of a trapezoid with sides
10 cm, 5 cm, 7 cm and 4 cm is?   26 cm

<u>Mathematics for the Intermediate Division</u>

TOPIC N030000: Measurement of Plane Shapes

OBJECTIVE N030700: Calculating the area of a trapezoid

MODEL:

a cm

b cm   d cm   e cm

c cm
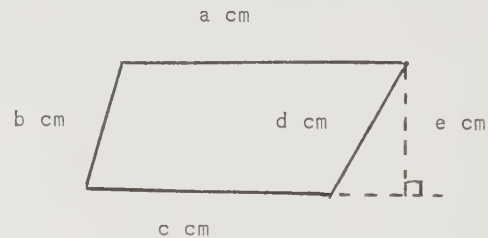
The area of a trapezoid with parallel
sides a cm and c cm and height e cm is?

2 $\leq$ a,b,c,d $\leq$ 10
a $\neq$ b $\neq$ c $\neq$ d
and e < d, e < b
at least one of e or the sum (a + c)
must be an even number

EXAMPLES:
N030701

5 cm

4 cm   6 cm

9 cm

7 cm
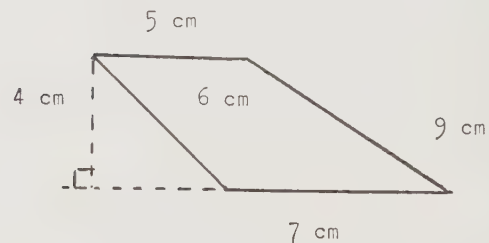
The area of a trapezoid with parallel
sides 5 cm and 7 cm and height 4 cm
is?   24 cm^2

OBJECTIVE N030700 (cont'd)

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Mathematics for the Intermediate Division

TOPIC N030000: Measurement of Plane Shapes

EXAMPLES:
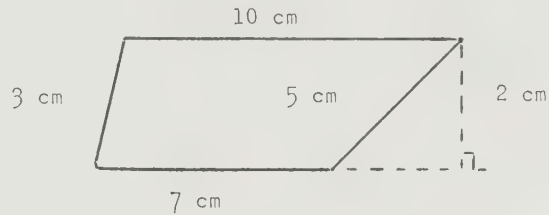
N030702

The area of a trapezoid with parallel sides 10 cm and 7 cm and height 2 cm is?   17 cm^2

N030703
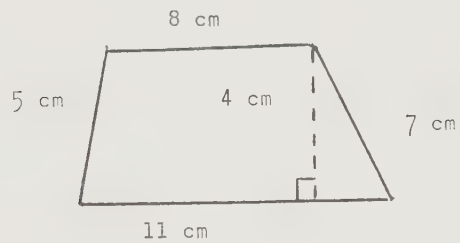
The area of a trapezoid with parallel sides 8 cm and 11 cm and height 4 cm is?   38 cm^2

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Mathematics for the Intermediate Division

TOPIC N030000: Measurement of Plane Shapes

(a) Reference(s) to the Curriculum Guideline:
     Grade 7   N 8e
     Grade 8   N 7a
     Grade 9 Basic N 9c
              Mod   N 8b (Courses A,B)
     Grade 10 Mod   N 8a (Course C)
                     N 8b (Course C)

(b) Difficulty Level:
     pre-instruction = .05, post-instruction = .65

OBJECTIVE N030800: Calculating circumference of a circle

MODEL: The circumference of a circle with diameter
          x cm is? (to the nearest tenth)
          $1 \leq x \leq 20$

EXAMPLES:

          N030801   The circumference of a circle with
                     diameter 10 cm is? (to the nearest tenth)
                     31.4 cm
          N030802   The circumference of a circle with
                     diameter 9 cm is? (to the nearest tenth)
                     28.3 cm
          N030803   The circumference of a circle with
                     diameter 16 cm is? (to the nearest tenth)
                     50.3 cm

MODEL: The circumference of a circle with a radius of
          x cm is? (to the nearest tenth)
          $1 \leq x \leq 20$

OBJECTIVE N030800 (cont'd)

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Mathematics for the Intermediate Division
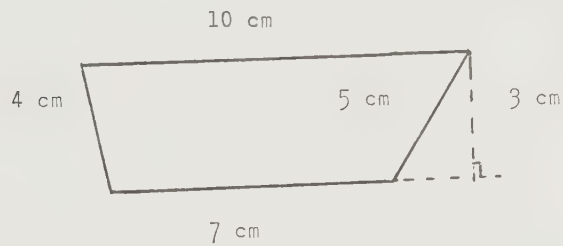
TOPIC N030000: Measurement of Plane Shapes

EXAMPLES:

N030804   The circumference of a circle with a
          radius of 6 cm is? (to the nearest tenth)
          37.7 cm

N030805   The circumference of a circle with a
          radius of 19 cm is? (to the nearest tenth)
          119.4 cm

N030806   The circumference of a circle with a
          radius of 2 cm is? (to the nearest tenth)
          12.6 cm

Mathematics for the Intermediate Division

TOPIC N030000: Measurement of Plane Shapes

OBJECTIVE N030900: Calculating the area of a circle

MODEL: What is the area of a circle with diameter
           y cm? (to the nearest tenth)

           $y = 2z$
           $1 \leq z \leq 10$

EXAMPLES:

    N030901   What is the area of a circle with
               diameter 14 cm? (to the nearest tenth)
               153.9 cm^2

    N030902   What is the area of a circle with
               diameter 10 cm? (to the nearest tenth)
               78. 5 cm^2

    N030903   What is the area of a circle with
               diameter 6 cm? (to the nearest tenth)
               28.3 cm^2

MODEL: What is the area of a circle with radius
           x cm? (to the nearest tenth)

           $1 \leq x \leq 10$

OBJECTIVE N030900 (cont'd)

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<u>Mathematics for the Intermediate Division</u>

TOPIC N030000: Measurement of Plane Shapes

EXAMPLES:

N030904   What is the area of a circle with
           radius 5 cm? (to the nearest tenth)
           78.5 cm^2

N030905   What is the area of a circle with
           radius 7 cm? (to the nearest tenth)
           153.9 cm^2

N030906   What is the area of a circle with
           radius 2 cm? (to the nearest tenth)
           12.6 cm^2

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<u>Mathematics for the Intermediate Division</u>

TOPIC N031000: Measurement of Three-Dimensional Shapes

(a) Reference(s) to the Curriculum Guideline:
     Grade 7   N 8f
     Grade 8   N 6c
                      N 7c
     Grade 9 Gen   N 6e
              Basic   N 9d
              Mod   N 8d (Courses A,B)
                      G 3a (Courses A,B)
                      G 3b (Courses A,B)
     Grade 10 Adv   G 6a
              Mod   N 8c (Course C)
                      G 3a (Course C)
                      G 3b (Course C)

(b) Difficulty Level:
     pre-instruction = .05, post-instruction = .88

OBJECTIVE N031100: Identifying various prisms and
                   pyramids

MODEL: Which of the following shapes is a [figure]?
           Write the letter

           Figure = [rectangular prism (box or cuboid)
                    triangular prism, cylinder
                    (circular prism), triangular pyramid
                    (tetrahedron), rectangular pyramid,
                    cone (circular pyramid)]

           Use three figures:- the correct one
                             - one with the same base but
                               either a prism or pyramid
                               so that it is different from
                               the correct one
                             - another random prism or
                               pyramid

OBJECTIVE N031100 (cont'd)

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Mathematics for the Intermediate Division

TOPIC N031000: Measurement of Three-Dimensional Shapes

EXAMPLES:

N031101　Which of the following shapes is a triangular pyramid?

a　　　　　　　　b　　　　　　c

Write the letter - c

N031102　Which of the following shapes is a rectangular prism?

a　　　　b　　　　c

Write the letter - c

N031103　Which of the following shapes is a cylinder?

a　　　　b　　　　c
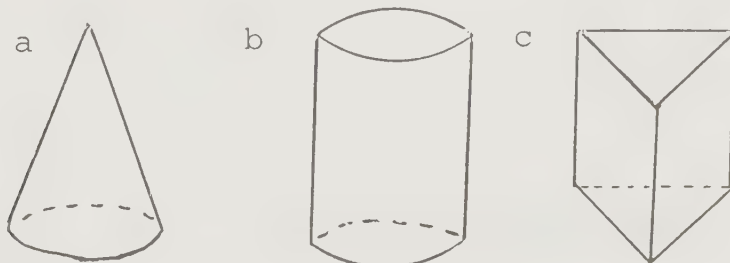
Write the letter - b

OBJECTIVE N031100 (cont'd)

Mathematics for the Intermediate Division

TOPIC N031000: Measurement of Three-Dimensional Shapes

OBJECTIVE N031200:   Calculating the volume of a prism

MODEL:

x cm

x cm

x cm

The volume of a cube with edge
x cm is?

$1 \leq x \leq 6$

EXAMPLE:

N031201

5 cm

5 cm

5 cm
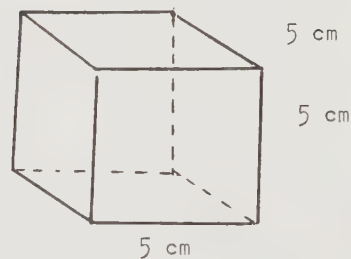
The volume of a cube with edge 5 cm is?
125 cm^3

OBJECTIVE N031200 (cont'd)

Mathematics for the Intermediate Division

TOPIC N031000: Measurement of Three-Dimensional Shapes

MODEL:

x cm

area of the base = y cm^2

The volume of a triangular prism with area of base y cm^2 and height x cm is?

$$2 \leq x \leq 10$$
$$6 \leq y \leq 30$$

EXAMPLES:

N031202

2 cm

area of the base = 26 cm^2

The volume of a triangular prism with area of base 26 cm^2 and height 2 cm is?

52 cm^3

OBJECTIVE N031200 (cont'd)

Mathematics for the Intermediate Division

TOPIC N031000: Measurement of Three-Dimensional Shapes
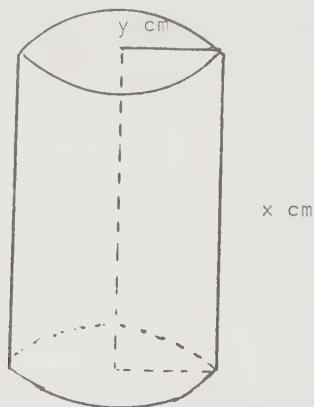
MODEL:

The volume of a cylinder with radius y cm and height x cm is?

$1 \le y \le 5$
$1 \le x \le 10$

EXAMPLE:

N031203
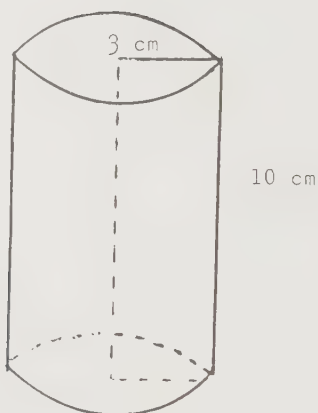
The volume of a cylinder with radius 3 cm and height 10 cm is?

282.7 cm^3

MODEL:
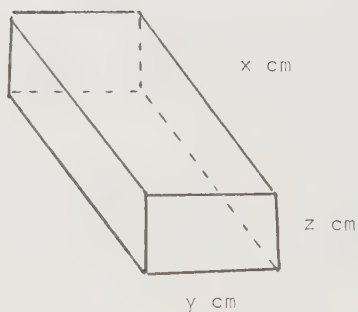
The volume of a rectangular prism of length x cm, width y cm and height z cm is?

$5 \le x \le 15$
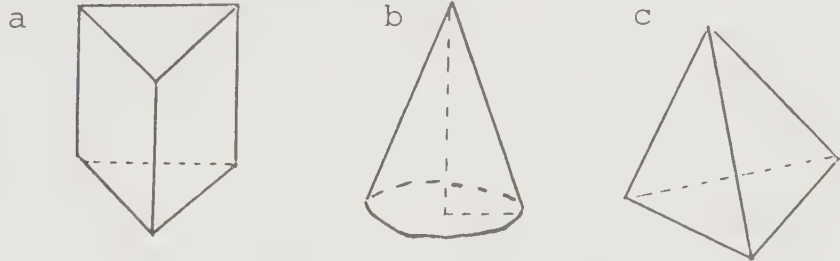$1 \le y < x$
$1 \le z < x$

OBJECTIVE N031200 (cont'd)

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Mathematics for the Intermediate Division

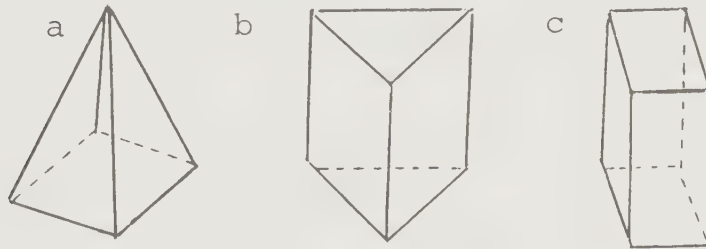TOPIC N031000: Measurement of Three-Dimensional Shapes

EXAMPLE:

N031204

15 cm

9 cm

9 cm
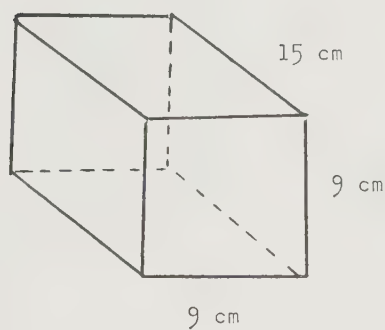
The volume of a rectangular prism of length 15 cm, width 9 cm and height 9 cm is?

1215 cm^3

Mathematics for the Intermediate Division

TOPIC N031000: Measurement of Three-Dimensional Shapes

OBJECTIVE N031300:   Calculating the volume of a pyramid

MODEL:
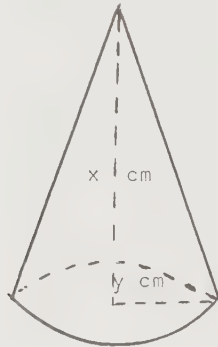
The volume of a cone with radius of base y cm and height x cm is?

$x = 3w$
$1 \leq w \leq 10$
$1 \leq y \leq w + 1$

EXAMPLES:

N031301
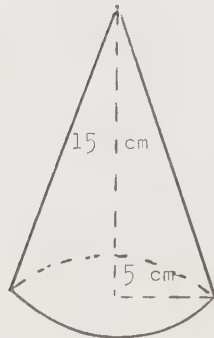
The volume of a cone with radius of base 5 cm and height 15 cm is?
392.7 cm^3

N031302
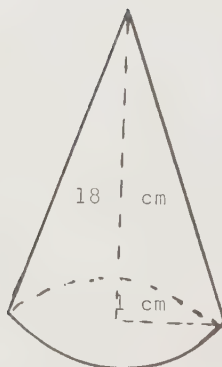
The volume of a cone with radius of base 1 cm and height 18 cm is?
18.8 cm^3

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TOPIC N031000: Measurement of Three-Dimensional Shapes

MODEL:

h = x cm

A = y cm^2
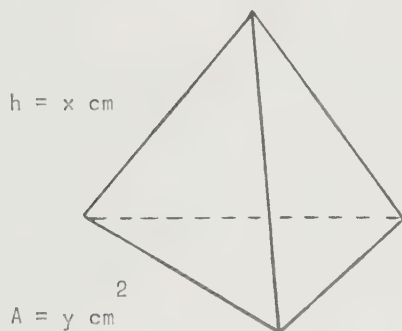
The volume of a triangular pyramid with area of base y cm^2 and height x cm is?

$2 \leq x \leq 9$

$y = 3z$

$2 \leq z \leq 20$

EXAMPLE:

N031303

h = 6 cm
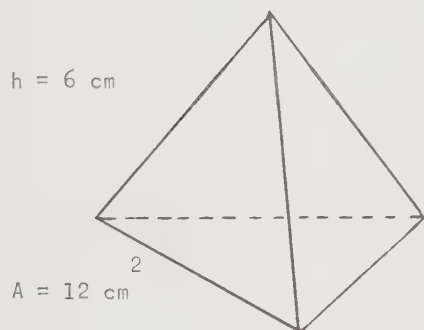
A = 12 cm^2

The volume of a triangular pyramid with area of base 12 cm^2 and height 6 cm is?

24 cm^3

OBJECTIVE N031300 (cont'd)
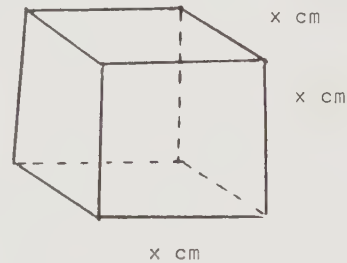
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TOPIC N031000: Measurement of Three-Dimensional Shapes

MODEL:
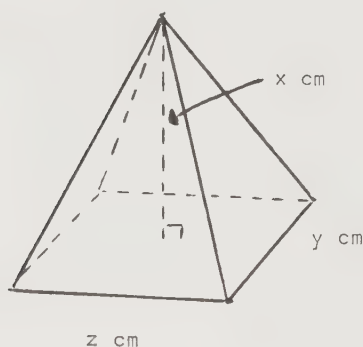
The volume of a rectangular pyramid with length of base z cm, width of base y cm, and height x cm is?

$2 \leq x \leq 10$

$1 \leq y < z$

$4 \leq z \leq 10$

EXAMPLE:

N031304
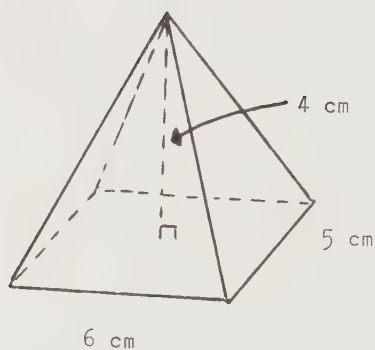
The volume of a rectangular pyramid with length of base 6 cm, width of base 5 cm, and height 4 cm is?

40 cm^3

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Mathematics for the Intermediate Division

ALGEBRA

TOPIC A001000:   Introducing Variables

(a)   Reference(s) to the Curriculum Guideline:
      Grade 7   A 2a
      Grade 8   A 1a
      Grade 9   Gen   A 1b
                Basic A 1c
      Grade 10

(b)   Difficulty Level:
      pre-instruction = .98, post-instruction = .93

OBJECTIVE A001100:   Using n to represent a number

MODEL: $n = a \times b$
           $n = ?$
           $2 \leq a \leq 12$

EXAMPLES:

           A001101 $n = 3 \times 6$

                      $n = ?$ 18

           A001102 $n = 7 \times 8$

                      $n = ?$ 56

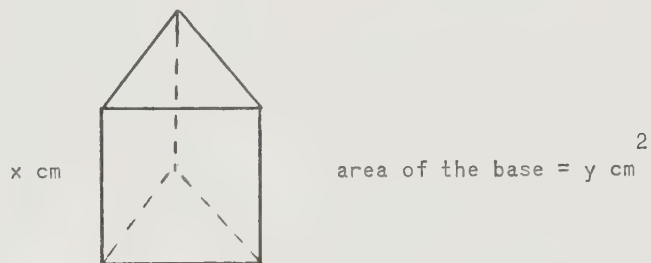   A001103 $n = 9 \times 11$

                      $n = ?$ 99

OBJECTIVE A001100 (cont'd)

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TOPIC A001000: Introducing Variables

MODEL: n = c/b
           n = ?
           2 $\leq$ n, b $\leq$ 12
           c = n x b

EXAMPLES:

        A001104   n = 16/8

                    n = ?   2

        A001105   n = 44/11

                    n = ?   11

        A001106   n = 96/8

                    n = ?   12

MODEL: n = a + b
           n = ?
            2 $\leq$ a, b $\leq$ 12

EXAMPLES:

        A001107   n = 8 + 4

                    n = ?   12

        A001108   n = 9 + 6

                    n = ?   15

        A001109   n = 9 + 11

                    n = ?   20

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Mathematics for the Intermediate Division

TOPIC A002000: Translating of Simple Algebraic Expressions

(a) Reference(s) to the Curriculum Guideline:
     Grade 7   A 2a
     Grade 8   A 1a
     Grade 9 Gen   A 1b
              Basic A 1c
              Mod   N 5b
     Grade 10

(b) Difficulty Level:
     pre-instruction = .85, post-instruction = .93

OBJECTIVE A002100: Recognizing algebraic translation of
                    simple phrases and vice-versa

MODEL: Which of the following means
           "a minus a number"?
           a. n - a   b. n + a   c. n/a
           d. an   e. a/n   f. a - n
           Random order of choices $2 \leq a \leq 50$
           Type a,b,c,d,e or f.

OBJECTIVE A002100 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC A002000:   Translating of Simple Algebraic Expressions

EXAMPLES:

A002101   Which of the following means
          "9 minus a number?

          a. 9n   b. n - 9   c. n + 9
          d. n/9   e. 9 - n   f. 9/n
          Type a,b,c,d,e or f   e

A002102   Which of the following means
          "21 minus a number"?

          a. 21 - n   b. 21/n   c. n - 21
          d. 21n   e. n + 21   f. n/21
          Type a,b,c,d,e or f.   a

A002103   Which of the following means
          "39 minus a number"?

          a. n - 39   b. n + 39   c. n/39
          d. 39n   e. 39/n   f. 39 - n
          Type a,b,c,d,e or f.   f

OBJECTIVE A002100 (cont'd)

Mathematics for the Intermediate Division

TOPIC A002000:   Translating of Simple Algebraic Expressions

MODEL: Which of the following means "a divided by
a number"?
a. n - a   b. n + a   c. n/a
d. an   e. a/n   f. a - n
Random order of choices, 2 ≤ a ≤ 50
Type a,b,c,d,e or f.

EXAMPLES:

A002104   Which of the following means
"3 divided by a number"?

a. 3n   b. 3 - n   c. n - 3

d. n/3   e. 3/n   f. n + 3

Type a,b,c,d,e or f.   e

A002105   Which of the following means
"29 divided by a number"?

a. n/29   b. 29n   c. 29 - n

d. n + 29   e. n - 29   f. 29/n

Type a,b,c,d,e or f.   f

A002106   Which of the following means
"48 divided by a number"?

a. n/48   b. n - 48   c. 48n

d. n + 48   e. 48/n   f. 48 - n

Type a,b,c,d,e or f.   e

OBJECTIVE A002100 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC A002000: Translating of Simple Algebraic Expressions

MODEL: Which of the following is the meaning of n + a?
           a. a divided by a number
           b. a number plus a
           c. a number multiplied by a
           d. a minus a number
           e. a number divided by a
           f. a number minus a
           Random order of choices, 2 ≤ a ≤ 50
           Type a,b,c,d,e or f.

EXAMPLES:

           A002107   Which of the following is the meaning of
                      n + 13?
                      a. a number plus 13
                      b. a number divided by 13
                      c. a number minus 13
                      d. a number multiplied by 13
                      e. 13 divided by a number
                      f. 13 minus a number
                      Type a,b,c,d,e or f.   a

OBJECTIVE A002100 (cont'd)

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Mathematics for the Intermediate Division

TOPIC A002000: Translating of Simple Algebraic Expressions

EXAMPLES:

    A002108   Which of the following is the meaning of
                $n + 34$?
                a. 34 divided by a number
                b. a number minus 34
                c. a number divided by 34
                d. a number plus 34
                e. 34 multiplied by a number
                f. 34 minus an number
                Type a,b,c,d,e or f.   d

    A002109   Which of the following is the meaning of
                $n + 46$?
                a. 46 minus a number
                b. a number divided by 46
                c. a number plus 46
                d. 46 divided by a number
                e. a number minus 46
                f. a number multiplied by 46
                Type a,b,c,d,e or f.   c

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<u>Mathematics for the Intermediate Division</u>

TOPIC A002000:   Translating of Simple Algebraic Expressions

OBJECTIVE A002200:   Translating simple phrases

MODEL: Using the variable n, type an expression
           which means "a divided by a number".
           $2 \le a \le 50$

EXAMPLES:

           A002201   Using the variable n, type an
                      expression which means
                      "13 divided by a number".   13/n
           A002202   Using the variable n, type an
                      expression which means
                      "29 divided by a number".   29/n
           A002203   Using the variable n, type an
                      expression which means
                      "47 divided by a number".   47/n

MODEL: Using the variable n, type an expression
           which means "a number multiplied by a".
           $2 \le a \le 50$

OBJECTIVE A002200 (cont'd)

Mathematics for the Intermediate Division

TOPIC A002000:   Translating of Simple Algebraic Expressions

EXAMPLES:

        A002204   Using the variable n, type an expression which means "a number multiplied by 9".   9n

        A002205   Using the variable n, type an expression which means "a number multiplied by 33". 33n

        A002206   Using the variable n, type an expression which means "a number multiplied by 45". 45n

MODEL: Using the variable n, type an expression which means "a multiplied by a number".
$2 \leq a \leq 50$

EXAMPLES:

        A002207   Using the variable n, type an expression which means "11 multiplied by a number". 11n

        A002208   Using the variable n, type an expression which means "31 multiplied by a number". 31n

        A002209   Using the variable n, type an expression which means "47 multiplied by a number". 47n

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<u>Mathematics for the Intermediate Division</u>

TOPIC A003000: Evaluating Expressions

(a) Reference(s) to the Curriculum Guideline:
     Grade 7
     Grade 8   A 1
     Grade 9   Adv   A 2a
               Gen   A 1b
               Basic A 1c
     Grade 10

(b) Difficulty Level:
     pre-instruction = .83, post-instruction = .93

OBJECTIVE A003100: Substituting with one operation

MODEL: If $n = x$, then $yn = ?$
           $2 \leq x$, $y \leq 9$, $x \neq y$

EXAMPLES:

           A003101   If $n = 2$, then $5n = ?$ 10

           A003102   If $n = 6$, then $2n = ?$ 12

           A003103   If $n = 8$, then $9n = ?$ 72

MODEL: If $n = d$, then $n/c = ?$
           $2 \leq c$, $k \leq 9$, $d = ck$

OBJECTIVE A003100 (cont'd)

Mathematics for the Intermediate Division

TOPIC A003000: Evaluating Expressions

EXAMPLES:

A003104	If n = 24, then n/4 = ?	6
A003105	If n = 56, then n/8 = ?	7
A003106	If n = 72, then n/9 = ?	8

MODEL: If n = s, then t - n = ?
$2 \leq t, \ s \leq 20,$ $t > s$

EXAMPLES:

A003107	If n = 6, then 12 - n = ?	6
A003108	If n = 15, then 18 - n = ?	3
A003109	If n = 9, then 16 - n = ?	7

Mathematics for the Intermediate Division

TOPIC A003000: Evaluating Expressions

OBJECTIVE A003200: Substituting with two operations

MODEL: If n = t, then b - an = ?
            $2 \leq a,\ t \leq 9$
            $10 \leq b \leq 50$
            $b \geq at$

EXAMPLES:

            A003201   If n = 2, then 9 - 4n = ?   1

            A003202   If n = 6, then 16 - 2n = ?   4

            A003203   If n = 9, then 41 - 3n = ?   14

MODEL: If n = k, then b + n/a = ?
            $2 \leq a,\ k \leq 9$
            $1 \leq t \leq 9$
            $k = at$

EXAMPLES:

            A003204   If n = 8, then 7 + n/2 = ?   11

            A003205   If n = 21, then 5 + n/7 = ?   8

            A003206   If n = 56, then 9 + n/8 = ?   16

OBJECTIVE A003200 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC A003000:   Evaluating Expressions

MODEL: If a = t, then an + b = ?
            $2 \leq a \leq 9$
            $0 \leq t \leq 9$
            $1 \leq b \leq 20$

EXAMPLES:

A003207   If n = 4, then 5n + 13 = ?   33

A003208   If n = 5, then 7n + 8 = ?   43

A003209   If n = 9, then 8n + 17 = ?   89

Mathematics for the Intermediate Division

TOPIC A003000: Evaluating Expressions

OBJECTIVE A003300: Substituting for variables
appearing more than once

MODEL: If $n = s$, then $c + an - bn = ?$
$2 \leq a \leq 9$
$0 \leq s \leq 12$
$1 \leq b \leq 9$
$1 \leq c \leq 15$
$a \geq b$

EXAMPLES:

A003301   If $n = 11$, then $8 + 6n - 6n = ?$ 8

A003302   If $n = 4$, then $12 + 7n - 3n = ?$ 28

A003303   If $n = 7$, then $14 + 9n - 4n = ?$ 49

MODEL: If $n = s$, then $an + c + bn = ?$
$2 \leq a \leq 9$
$0 \leq s \leq 12$
$1 \leq b \leq 9$
$1 \leq c \leq 15$

EXAMPLES:

A003304   If $n = 3$, then $3n + 10 + n = ?$ 22

A003305   If $n = 5$, then $4n + 3 + 9n = ?$ 68

A003306   If $n = 8$, then $5n + 13 + 7n = ?$ 109

OBJECTIVE A003300 (cont'd)

Mathematics for the Intermediate Division

TOPIC A003000:   Evaluating Expressions

MODEL: If $n = s$, then $an + bn - c = ?$
$2 \leq a \leq 9$
$0 \leq s \leq 12$
$1 \leq b \leq 9$
$1 \leq c \leq 15$
$(a + b)$ s>c

EXAMPLES:

A003307	If $n = 6$, then $3n + 2n - 10 = ?$	20
A003308	If $n = 10$, then $8n + 9n - 6 = ?$	164
A003309	If $n = 9$, then $6n + 4n - 15 = ?$	75

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Mathematics for the Intermediate Division

TOPIC A004000:   Solving Equations By Inspection

(a)   Reference(s) to the Curriculum Guideline:
      Grade 7   A 2b
      Grade 8   A 1d
      Grade 9   Adv   A 2a
                Gen   A 1b
      Grade 10

(b)   Difficulty Level:
      pre-instruction = .91,   post-instruction = .96

OBJECTIVE A004100:   Solving simple equations

MODEL: If x + a = b, what is the value of x?
           x ∈ {x,y,z,a,b,c,s,t,m,n}
           1 ≤ a,b ≤ 12
           b > a

EXAMPLES:

           A004101   If c + 4 = 10

                      what is the value of c?   6

           A004102   If y + 7 = 12

                      what is the value of y?   5

           A004103   If m + 3 = 11

                      what is the value of m?   8

OBJECTIVE A004100 (cont'd)

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<u>Mathematics for the Intermediate Division</u>

TOPIC A004000:   Solving Equations By Inspection

MODEL: If cx = d, then x = ?
            $x \in \{x,y,z,a,b,c,s,t,m,n\}$
            d = ac
            $2 \leq c \leq 12$
            $1 \leq a \leq 12$

EXAMPLES:

            A004104   If 3t = 12, then t = ?   4

            A004105   If 11s = 33, then s = ?   3

            A004106   If 7n = 63, then n = ?   9

MODEL: If a + x = b, then x = ?
            $x \in \{x,y,z,a,b,c,s,t,m,n\}$
            $1 \leq a,b \leq 12$
            b>a

EXAMPLES:

            A004107   If z + 3 = 4, then z = ?   1

            A004108   If y + 4 = 10, then n = ?   6

            A004109   If b + 7 = 12, then b = ?   5

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Mathematics for the Intermediate Division

TOPIC A004000: Solving Equations By Inspection

OBJECTIVE A004200: Solving two-operation equations

MODEL: If c - ax = b, then x = ?
            $x \in \{x,y,z,a,b,c,s,t,m,n\}$
            $2 \leq a \leq 5$
            $1 \leq b, x \leq 6$ $c = ax + b$

EXAMPLES:

            A004201   If 9 - 3c = 3, then c = ?   2

            A004202   If 18 - 4y = 2, then y = ?   4

            A004203   If 41 - 7m = 6, then m = ?   5

MODEL: If b + ax = c, then x = ?
            $x \in \{x,y,z,a,b,c,s,t,m,n\}$
            $2 \leq a \leq 5$
            $1 \leq b, x \leq 6$ $c = ax + b$

EXAMPLES:

            A004204   If 6 + 2z = 12, then z = ?   3

            A004205   If 1 + 4b = 17, then b = ?   4

            A004206   If 6 + 6x = 24, then x = ?   3

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Mathematics for the Intermediate Division

TOPIC A005000:   Solving Inequalities

(a)   Reference(s) to the Curriculum Guideline:
      Grade 7
      Grade 8   A 1e
      Grade 9   Adv   A 4b
                Gen   A 1c
      Grade 10

(b)   Difficulty Level:
      pre-instruction = .74, post-instruction = .82

OBJECTIVE A005100:   Recognizing the symbols $<,>,=$

MODEL: a $\uparrow$ b

            What is the missing symbol ($<,>$ or $=$)?

            $5 \leq a,b \leq 25$

            $a = b$ one out of five times

EXAMPLES:

            A005101   25 $\uparrow$ 8

                         What is the missing symbol ($<,>$ or $=$)?

                         $>$

            A005102   14 $\uparrow$ 20

                         What is the missing symbol ($<,>$ or $=$)?

                         $<$

            A005103   16 $\uparrow$ 16

                         What is the missing symbol ($<,>$ or $=$)?

                         $=$

Mathematics for the Intermediate Division

TOPIC A005000:   Solving Inequalities

OBJECTIVE A005200:   Using the symbols <,>,=

MODEL: If x = n, then a - 2x $\uparrow$ b
            What is the missing symbol (<,> or =)?
            x $\notin$ {a,b,x,y,s,t,m,n}
            3 $\leq$ n $\leq$ 7
            2 $\leq$ b $\leq$ 10   a = b + 10

EXAMPLES:

      A005201   If s = 5, then 14 - 2s $\uparrow$ 4

               What is the missing symbol (<,> or =)?

               =

      A005202   If n = 7, then 14 - 2n $\uparrow$ 4

               What is the missing symbol (<,>, or =)?

               <

      A005203   If y = 8, then 19 - 2y $\uparrow$ 9

               What is the missing symbol (<,> or =)?

               <

MODEL: If x = n, then a - x $\uparrow$ b
            What is the missing symbol (<,> or =)?
            x $\notin$ {a,b,x,y,s,t,m,n}
            3 $\leq$ n $\leq$ 7
            2 $\leq$ b $\leq$ 15   a = b + 5

OBJECTIVE A005200 (cont'd)

Mathematics for the Intermediate Division

TOPIC A005000: Solving Inequalities

EXAMPLES:

        A005204   If $x = 6$, then $8 - x$ ⇡ 3

                     What is the missing symbol ($<,>$ or $=$)?

                     $<$

        A005205   If $s = 3$, then $19 - s$ ⇡ 14

                     What is the missing symbol ($<,>$ or $=$)

                     $>$

        A005206   If $m = 5$, then $12 - m$ ⇡ 7

                     What is the missing symbol ($<,>$ or $=$)?

                     $=$

MODEL: If $x = n$, then $x + a$ ⇡ b
            What is the missing symbol ($<,>$ or $=$)?
            $x \in \{a,b,x,y,s,t,m,n\}$
            $1 \leq a \leq 15$
            $3 \leq n \leq 7$ $b = a + 4$

OBJECTIVE A005200 (cont'd)

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<u>Mathematics for the Intermediate Division</u>

TOPIC A005000:   Solving Inequalities

EXAMPLES:

A005207   If t = 4, then t + 15 $\uparrow$ 19

What is the missing symbol (<,> or =)?

=

A005208   If y = 5, then y + 9 $\uparrow$ 13

What is the missing symbol (<,> or =)?

>

A005209   If n = 3, then n + 16 $\uparrow$ 20

What is the missing symbol (<,> or =)?

<

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<u>Mathematics for the Intermediate Division</u>

TOPIC A005000:   Solving Inequalities

OBJECTIVE A005300:   Solving inequalities

MODEL: If a + x > b, what is one possible value for x?
            What is another value for x that makes
            a + x > b a true statement?
            x∈{a,b,x,y,s,t,m,n}
            b > a + 1
            1 ≤ a ≤ 10
            3 ≤ b ≤ 12

EXAMPLES:

        A005301   If 1 + b > 8, what is one possible
                   value for b? What is another value
                   for b that makes 1 + b > 8 a true
                   statement?   8,9,10,11...

        A005302   If 5 + s > 11, what is one possible
                   value for s? What is another value
                   for s that makes 5 + s > 11 a true
                   statement?   7,8,9,10...

        A005303   If 9 + t > 12, what is one possible
                   value for t? What is another value
                   for t that makes 9 + t > 12 a true
                   statement?   4,5,6,7...

OBJECTIVE A005300 (Cont'd)

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<u>Mathematics for the Intermediate Division</u>

TOPIC A005000:   Solving Inequalities

MODEL: If x + a < b, what is one possible value for
            x? What is another value for x that makes
            x + a < b a true statement?
            x ∈ {a,b,x,y,s,t,m,n}
            1 ≤ a ≤ 10
            3 ≤ n ≤ 9   b = a + n

EXAMPLES:

            A005304   If b + 5 < 10, what is one possible
                        value for b? What is another value
                        for b that makes b + 5 < 10 a true
                        statement?   0,1,2,3,4

            A005305   If m + 7 < 13, what is one possible
                        value for m? What is another value
                        for m that makes m + 7 < 13 a true
                        statement?   0,1,2,3,4,5

            A005306   If t + 2 < 10, what is one possible
                        value for t? What is another value
                        for t that makes t + 2 < 10 a true
                        statement?   0,1,2,3,4,5,6,7

OBJECTIVE A005300 (cont'd)

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<u>Mathematics for the Intermediate Division</u>

TOPIC A005000:   Solving Inequalities

MODEL: If 2x + a > b, what is one possible value
            for x? What is another value for x that makes
            2x + a > b a true statement?
            x ∈{a,b,x,y,s,t,m,n}
            1 ≤ a ≤ 10
            5 ≤ b ≤ 15,   b > a + 4

EXAMPLES:

        A005307   If 2t + 1 > 14, what is one possible
                    value for t? What is another value
                    for t that makes 2t + 1 > 14 a true
                    statement?   7,8,9,10...

        A005308   If 2y + 6 > 15, what is one possible
                    value for y? What is another value
                    for y that makes 2y + 6 > 15 a true
                    statement?   5,6,7,8...

        A005309   If 2a + 3 > 11, what is one possible
                    value for a? What is another value
                    for a that makes 2a + 3 > 11 a true
                    statement?   5,6,7,8...

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Mathematics for the Intermediate Division

TOPIC A006000: Translating of Complex Algebraic
Expressions

(a) Reference(s) to the Curriculum Guideline:
    Grade 7   A 2a
    Grade 8   A 1a
    Grade 9 Adv   A 2a
          Gen   A 1b
    Grade 10

(b) Difficulty Level:
    pre-instruction = .90, post-instruction = .93

OBJECTIVE A006100:   Recognizing algebraic translation of
phrases and vice-versa

MODEL: Which of the following means, "multiply a number
by x, then add b"?
a. $bn + x$ b. $xn + b$
c. $x(n + b)$ d. $b(n + x)$
Type a,b,c,or d
Random order of choices
$b, x \in \{2,3,4,\ldots,50\}$ $x = b$
$n \in \{a,b,c,f,g,n,m,x,y\}$

OBJECTIVE A006100 (cont'd)

Mathematics for the Intermediate Division

TOPIC A006000: Translating of Complex Algebraic
Expressions

EXAMPLES:

A006101   Which of the following means, "multiply
a number by 8, then add 9"?
a. 8(g + 9)   b. 9(g + 8)
c. 8g + 9   d. 9g + 8
Type a,b,c,or d.   c

A006102   Which of the following means, "multiply
a number by 47, then add 27"?
a. 27m + 47   b. 47m + 27
c. 27(m + 47)   d. 47(m + 27)
Type a,b,c,or d.   b

A006103   Which of the following means "multiply
a number by 39, then add 93"?
a. 93(x + 39)   b. 93x + 39
c. 39x + 93   d. 39(x + 93)
Type a,b,c or d.   c

MODEL: Which of the following is the meaning of
(n - b)/x?
a.   A number divided by x, then diminished
by b
b.   A number diminished by b/x
c.   A number divided by (n-b)
d.   A number decreased by b, then divided
by x
Type a,b,c, or d.
Random order of choices
$b, x \in \{2,3,4,\ldots,50\}$ $x \neq b$
$n \in \{a,b,c,b,g,n,m,x,y\}$

OBJECTIVE A006100 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A006000: Translating of Complex Algebraic
Expressions

EXAMPLES:

A006104   Which of the following is the meaning
of (a - 3)/2?

a.   A number divided by 2, then diminished
by 3

b.   A number diminished by 3/2

c.   A number divided by a - 3

d.   A number decreased by 3 and then divided
by 2

Type a,b,c, or d.   d

A006105   Which of the following is the meaning
of (h - 36)/12?

a.   A number divided by h - 36

b.   A number diminished by 36/12

c.   A number decreased by 36, and then divide
by 12

d.   A number divided by 12 then diminished
by 36

Type a,b,c, or d.   c

A006106   Which of the following is the meaning
of (c - 6)/48?

a.   A number diminished by 6/48

b.   A number decreased by 6, and then divided
by 48

c.   A number divided by 48, then diminished
by 6

d.   A number divided by c - 6

Type a,b,c, or d.   b

OBJECTIVE A006100 (cont'd)

Mathematics for the Intermediate Division

TOPIC A006000: Translating of Complex Algebraic
               Expressions

MODEL: Which of the following means, "Divide a
number by x, then subtract b"?
a. n/x - b   b. (n - b)x
b. n/(x - b)   d. n - b/x
Type a,b,c, or d
Random order of choices
b,x$\in$\{2,3,4,...,50\} x $\neq$ b
n$\in$\{a,b,c,f,g,n,m,x,y\}

EXAMPLES:

    A006107   Which of the following means,

               "Divide a number by 8, then subtract 7"?

               a.   (m - 8)/7   b. m - 7/8

               c.   m/(8 - 7)   d. m/8 - 7

               Type a,b,c, or d.   d

    A006108   Which of the following means,

               "Divide a number by 30, then subtract
               32"?

               a.   f/(30 - 32)   b.   f/30 - 32

               c.   f - 32/30   d.   (f - 32)/30

               Type a,b,c, or d.   b

    A006109   Which of the following means, "Divide

               a number by 48, then subtract 16"?

               a.   n/48 - 16   b.   n/(48 - 16)

               c.   (n - 16)/48   d.   n - 16/48

               Type a,b,c, or d.   a

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Mathematics for the Intermediate Division

TOPIC A006000: Translating of Complex Algebraic
Expressions

OBJECTIVE A006200:   Translating phrases

MODEL: Using the variable n, type an expression which
means, "A number multiplied by x, then increased
by b"
x, b∈{2,3,4,...,50} x ≠ b
n∈{a,b,c,f,g,n,m,x,y}

EXAMPLES:

A006201   Using the variable a, type an expression
which means, "A number multiplied by
7, then increased by 9".   7a + 9

A006202   Using the variable m, type an expression
which means, "A number multiplied by
22, then increased by 13".   22m + 13

A006203   Using the variable x, type an expression
which means, "A number multiplied by
43, then increased by 39".   43x + 39

MODEL: Using the variable n, type an expression which means
"A number added to b, then divided by x"
x, b∈{2,3,4,...,50} x ≠ b
n∈{a,b,e,f,g,n,m,x,y}

OBJECTIVE A006200 (cont'd)

Mathematics for the Intermediate Division

TOPIC A006000: Translating of Complex Algebraic
Expressions

EXAMPLES:

A006204   Using the variable b, type an expression
which means, "A number added to 8,
then divided by 6".   (8 + b)/6

A006205   Using the variable y, type an expression
which means, "A number added to 50,
then divided by 29".   (50 + y)/29

A006206   Using the variable g, type an expression
which means, "A number added to 47,
then divided by 43".   (47 + g)/43

MODEL: Using the variable n, type an expression which
means, "Multiply a number by x, then subtract b"
$x, b \in \{2,3,4,\ldots,50\}$ $x \neq b$
$n \in \{a,b,c,f,g,n,m,x,z\}$

EXAMPLES:

A006207   Using the variable x, type an expression
which means, "Multiply a number by 5,
then subtract 9".   5x - 9

A006208   Using the variable n, type an expression
which means, "Multiply a number by 17,
then subtract 38".   17n - 38

A006209   Using the variable m, type an expression
which means, "Multiply a number by 43,
then subtract 34".   43m - 34

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<u>Mathematics for the Intermediate Division</u>

TOPIC A007000: Working With Expressions

(a) Reference(s) to the Curriculum Guideline:
     Grade 7
     Grade 8   A1a
     Grade 9
     Grade 10

(b) Difficulty Level:
     pre-instruction = .75, post-instruction .84

OBJECTIVE A007100: Abbreviating expressions

MODEL: What is the shortened form of y + y + ...+ y?
           3 $\leq$ number of terms (n) $\leq$ 9
           y$\in\{$a,b,d,m,p$\}$

EXAMPLES:

     A007101   What is the shortened form of
                d + d + d + d + d?   5d
        A007102   What is the shortened form of
                   a + a + a + a?   4a
        A007103   What is the shortened form of
                   p + p + p?   3p

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<u>Mathematics for the Intermediate Division</u>

TOPIC A007000:   Working With Expressions

OBJECTIVE A007200:   Substituting in expressions

MODEL: Suppose y = a.   Then b $\pm$ cy = ?
            y ϵ {a,b,d,m,p}
            -10 $\leq$ a $\leq$ 10   a $\neq$ 0
            0 $\leq$ b $\leq$ 50
            1 $\leq$ c $\leq$ 10

EXAMPLES:

            A007201   Suppose m = -4.   Then 16 + 3m = ?   4

            A007202   Suppose p = 8.   Then 30 - 2p = ?   14

            A007203   Suppose d = -5.   Then 43 - 3d = ?   58

MODEL: Suppose y = a.   Then by + c = ?
            y ϵ {a,b,d,m,p}
            -10 $\leq$ a $\leq$ 10   a $\neq$ 0
            1 $\leq$ b $\leq$ 9
            1 $\leq$ c $\leq$ 25

EXAMPLES:

            A007204   Suppose a =   3.   Then 6a + 9 = ?   27

            A007205   Suppose b =   6.   Then 7b + 14 = ?   56

            A007206   Suppose d = -10.   Then 7d - 22 = ?   -92

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<u>Mathematics for the Intermediate Division</u>

TOPIC A007000: Working With Expressions

OBJECTIVE A007300: Adding and subtracting expressions

MODEL: Simplify: ay $\pm$ by = ?
          yϵ\{m,n,p,q\}
          $- 20 \leq a,\ b \leq 20$ a,b $\neq$ 0

EXAMPLES:

A007301	Simplify -10n + 18n = ?	8n
A007302	Simplify -7n - 6n = ?	-13n
A007303	Simplify 12p - 15p = ?	- 3p

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Mathematics for the Intermediate Division

TOPIC A007000: Working With Expressions

OBJECTIVE A007400: Multiplying an expression by
an integer

MODEL: Suppose y = c.   Then by x a = ?
$y \in \{m,n,w,t\}$
$2 \leq a \leq 9$
$-9 \leq b \leq 9$ $b \neq 0,1$
$-9 \leq c \leq 9$ $c \neq 0$

EXAMPLES:

A007401   Suppose m = 4.   Then

8m x 6   = ?   192

A007402   Suppose t = 5.   Then

-9t x 3   = ?   -135

A007403   Suppose w = 6.   Then

-4w x 7   = ?   168

MODEL: Simplify: a x by = ?
$y \in \{m,n,w,t\}$
$-9 \leq a \leq 9$ $a \neq 0,1$
$2 \leq b \leq 9$

EXAMPLES:

A007404   Simplify: 9 x 7n = ?   63n

A007405   Simplify: 7 x 6t = ?   42t

A007406   Simplify: -8 x 9m = ?   -72m

OBJECTIVE 007400 (cont'd)

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Mathematics for the Intermediate Division

TOPIC A007000: Working With Expressions

MODEL: Suppose y = c.   Then a x by = ?
           y$\in$ {m,n,w,t}
           -9 $\leq$ a, c $\leq$ 9   a,c $\neq$ 0
           2 $\leq$ b $\leq$ 9

EXAMPLES:

           A007407   Suppose w = 5.   Then 8 x 6w   = ?   240

           A007408   Suppose m =-4.   Then 4 x 5m   = ?   -80

           A007409   Suppose n = 3.   Then -4 x 7n = ?   -84

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Mathematics for the Intermediate Division

TOPIC A007000:   Working With Expressions

OBJECTIVE A007500:   Evaluating expressions

MODEL: Suppose $y = d$.   Then ay/b = ?
            $y \in \{a,b,q,m\}$
            $2 \leq a,\ b \leq 12$
            $-10 \leq d \leq 10$ $d \neq 0,1$

EXAMPLES:

A007501   Suppose $a = 5$.   Then $8a/7$ = ?
            40/7 or 5 5/7

A007502   Suppose $b = 3$.   Then $12b/3$ = ?
            12

A007503   Suppose $q = -6$. Then $9q/5$ = ?
            -54/5 or -10 4/5

MODEL: Suppose $y = d$.   Then $(ay \pm c)/b$ = ?
            $y \in \{a,b,q,m\}$
            $2 \leq a,b,c \leq 12$
            $-10 \leq d \leq 10$ $d \neq 0,1$

EXAMPLES:

A007504   Suppose $a = 2$.   Then $(7a - 4)/3$ = ?
            10/3 or 3 1/3

A007505   Suppose $m = 7$.   Then $(9m + 7)/4$ = ?
            35/2 or 17 1/2

A007506   Suppose $b = -6$. Then $(5b - 8)/6$ = ?
            -19/3 or -6 1/3

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<u>Mathematics for the Intermediate Division</u>

TOPIC A007000: Working With Expressions

OBJECTIVE A007600: Simplifying and evaluating expressions

MODEL: Simplify: a x by ± c x dy = ?
           y ∈ {m,n,w,t)
           -10 ≤ a ≤ 10   a ≠ 0
           1 ≤ b̄,c,d̄ ≤ 10

EXAMPLES:

           A007601   Simplify: 6 x 3t + 4 x 5t = ?   38t

           A007602   Simplify: -8 x w - 6 x 2w = ?   -20w

           A007603   Simplify: -9 x 7m + 8 x 6m = ?   -15m

MODEL: Simplify: a x by ± c x d = ?
           y ∈ {m,n,w,t}
           -10 ≤ a ≤ 10   a ≠ 0
           1 ≤ b̄,c,d̄ ≤ 10

EXAMPLES:

           A007604   Simplify: 7 x 5w + 8 x 2   = ?
                       35w + 16

           A007605   Simplify: -8 x 3m - 4 x 3 = ?
                       -24m - 12

           A007606   Simplify: -6 x 9t + 7 x 8 = ?
                       -54t + 56

OBJECTIVE A007600 (cont'd)

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<u>Mathematics for the Intermediate Division</u>

TOPIC A007000: Working With Expressions

MODEL: Suppose $y = q$. Then $\dfrac{ay \overset{+}{-} b}{c} = ?$

$y \in \{m,n,w,t\}$
$-10 \leq a \leq 10$ $a \neq 0$
$1 \leq b,c \leq 10$
$-10 \leq q \leq 10$ $q \neq 0,1,-1$
c is a factor of q

EXAMPLES:

A007607   Suppose $n = 4$.   Then $\dfrac{5n - 8}{2} = ?$

12/2 or 6

A007608   Suppose $t = 7$.   Then $\dfrac{6t + 8}{7} = ?$

50/7 or 7 1/7

A007609   Suppose $w = -8$.   Then $\dfrac{7w + 9}{4} = ?$

-47/4 or -11 3/4

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Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A008000: Simplifying Expression in One Variable

(a) Reference(s) to the Curriculum Guideline:
     Grade 7
     Grade 8
     Grade 9   Adv   A2
               Gen   A2
     Grade 10 Gen   A3

(b) Difficulty Level:
     pre-instruction = .64, post-instruction = .71

OBJECTIVE A008100: Collecting like terms

MODEL: Simplify: ay $\pm$ b $\pm$ cy $\pm$ d = ?
           y ϵ {a,b,d,m,n}
           1 $\leq$ a, c $\leq$ 10
           0 $\leq$ b, d $\leq$ 10

EXAMPLES:

           A008101   Simplify: 6d + 4 + d + 8   = ?
                      7d + 12

           A008102   Simplify: 5n - 7 - 10n + 2 = ?
                      -5n - 5

           A008103   Simplify: 7b - 8 + 6b - 7 = ?
                      13b - 15

MODEL: Simplify: b $\pm$ d $\pm$ ay $\pm$ cy = ?
           y ϵ {a,b,d,m,n}
           1 $\leq$ a, c $\leq$ 10
           0 $\leq$ b, d $\leq$ 10

OBJECTIVE A008100 (cont'd)

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Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC A008000: Simplifying Expression in One Variable

EXAMPLES:

      A008104   Simplify: $7 + 8 - 4a - 6a = ?$

                      $15 - 10a$

      A008105   Simplify: $10 - 7 + 3m - 9m = ?$

                      $-6m + 3$

      A008106   Simplify: $9 - 10 - 2b + 8b = ?$

                      $-1 + 6b$

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Mathematics for the Intermediate Division

TOPIC A008000: Simplifying Expressions in One Variable

OBJECTIVE A008200: Removing brackets and collecting like
                    terms (positive coefficients)

MODEL: Simplify: $a(by \pm c) + d(ey \pm f) = ?$
           $y \in \{ a,b,d,m,n \}$
           $2 \leq a, d \leq 10$
           $0 \leq b,c,e,f \leq 10$ $b \neq e$

EXAMPLES:

A008201   Simplify: $2(8n + 4) + 6(2n - 10) = ?$

           $28n - 52$

A008202   Simplify: $10(6d + 6) + 6(10d - 5) = ?$

           $120d + 30$

A008203   Simplify: $4(-1) + 6(2m - 4) = ?$

           $12m - 28$

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Mathematics for the Intermediate Division

TOPIC A008000: Simplifying Expressions in One Variable

OBJECTIVE A008300: Removing brackets and collecting like
                    terms (negative coefficients)

MODEL: Simplify: $a(by \pm c) \pm dy \pm e$ = ?
            $y \epsilon \{a,b,d,m,n\}$
            $-10 \leq a \leq -1$
            $1 \leq b,c \leq 10$
            $0 \leq d,e \leq 10$

EXAMPLES:

    A008301   Simplify: $-4(7d - 2) + 7d$ = ?

               $-21d + 8$

    A008302   Simplify: $-7(3b + 5) - 7$ = ?

               $21b - 42$

    A008303   Simplify: $-(7a - 4) - 6a + 3$ = ?

               $-13a + 7$

MODEL: Simplify: $a - b(cy \pm d)$ = ?
            $y \epsilon \{m,n,t,w\}$
            $1 \leq a,b,c,d \leq 10$

EXAMPLES:

    A008304   Simplify: $9 - (7w + 6)$ = ?

               $-7w - 3$

    A008305   Simplify: $3 - 3(8t - 3)$ = ?

               $-24t + 12$

    A008306   Simplify: $3 - 9(5m + 10)$ = ?

               $-45m - 87$

OBJECTIVE A008300 (cont'd)

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<u>Mathematics for the Intermediate Division</u>

TOPIC A008000: Simplifying Expressions in One Variable

MODEL: Simplify: $ay - b(cy \pm d) = ?$
           $y \in \{m,n,t,w\}$
           $1 \leq a,b,d \leq 10$

EXAMPLES:

A008307   Simplify: $8m - 2(3m + 2) = ?$

           $2m - 4$

A008308   Simplify: $7w - (10w + 7) = ?$

           $-3w - 7$

A008309   Simplify: $6t - 4(5t - 3) = ?$

           $-14t + 12$

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Mathematics for the Intermediate Division

TOPIC A008000: Simplifying Expressions in One Variable

OBJECTIVE A008400: Removing brackets and collecting like
                    terms (positive and negative coefficients)

MODEL: Simplify: $a(by \pm c) \pm d(ey \pm f)$ = ?
            $y \epsilon \{f,g,j,k,m,n\}$
            $-10 \leq a \leq 10$ $a \neq o$
            $1 \leq b,d,e \leq 10$
            $0 \leq c,f \leq 10$

EXAMPLES:

        A008401   Simplify: $-6(9m + 9) - 5(2m + 5)$ = ?

                   $-64m - 79$

        A008402   Simplify: $-3 (3f - 1) + (9f - 1)$ = ?

                   2

        A008403   Simplify: $9(5m + 10) + 10(2m - 3)$ = ?

                   $65m + 60$

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A009000: Solving Simple First Degree Equations
in One Variable

(a) Reference(s) to the Curriculum Guideline:
Grade 7
Grade 8   A 1d
Grade 9 Adv   A 4a
Gen   A 1b
Basic A 1c
Grade 10

(b) Difficulty Level:
pre-instruction = .41, post-instruction = .71

OBJECTIVE A009100: Solving one-step equations

MODEL: x - a = b
x = ?
$x \in \{a,b,c\}$
$2 \leq a,b, \leq 24$ $a \neq b$

EXAMPLES:

A009101   b - 6 = 4

b = ?   10

A009102   a - 24 = 4

a = ?   28

A009103   c - 8 = 9

c = ?   17

MODEL: ax = b
x = ?
$x \in \{a,b,c\}$
$-24 \leq a \leq 24$ $a \neq 0,1$
$2 \leq b \leq 24$ a is a factor of b

OBJECTIVE A009100 (cont'd)

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<u>Mathematics for the Intermediate Division</u>

TOPIC A009000: Solving Simple First Degree Equations
in One Variable

EXAMPLES:

A009104   6b = 18

b = ?   3

A009105   -12c = 12

c = ?   -1

A009106   -4a = 24

a = ?   -6

MODEL: x/a = b
x = ?
$x \in \{a,b,c\}$
$2 \leq a,b \leq 24$ $a \neq b$

EXAMPLES:

A009107   b/3 = 5

b = ?   15

A009108   a/16 = 7

a = ?   112

A009109   c/23 = 11

c = ?   253

Mathematics for the Intermediate Division

TOPIC A009000: Solving Simple First Degree Equations
in One Variable

OBJECTIVE A009200: Solving two-step equations

MODEL: $a(x \pm b) = c$

              $x = ?$

$x \in \{m,p,q\}$

$-10 \le a \le 10 \quad a \ne 0, \pm1, \pm7, \pm9$

$2 \le b, c \le 25 \quad a \ne b \quad a$ is a factor of c

EXAMPLES:

     A009201 $3(m + 6) = 24$

                    $m = ?$ 2

     A009202 $-5(p - 40) = 5$

                    $p = ?$ 39

     A009203 $6(q - 3) = 18$

                    $q = ?$ 36

MODEL: $\dfrac{x \pm g}{a} = c$

            $x = ?$

$x \in \{m,p,q\}$

$-b \; 10 \le a \le 10 \quad a \ne 0, \pm1, \pm7, \pm9$

$2 \le b, c \le 25 \quad a \ne b$

OBJECTIVE A009100 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A009000: Solving Simple First Degree Equations
in One Variable

EXAMPLES:

A009204 $\dfrac{p + 7}{6} = 3$

p = ?   11

A009205 $\dfrac{m - 12}{8} = 7$

m = ?   68

A009206 $\dfrac{q + 15}{5} = 3$

q = ?   0

MODEL: ax + b = c
x = ?
$x \in \{m, p, q\}$
$-10 \leq a \leq 10$ $a \neq 0, \pm 1, \pm 7, \pm 9$
$2 \leq b, c \leq 25$ $a \neq b$

EXAMPLES:

A009207   4p - 7 = 5

p = ?   3

A009208   5m - 4 = 10

m = ?   14/5 or 2 4/5

A009209   8q + 15 = 25

q = ?   5/4

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<u>Mathematics for the Intermediate Division</u>

TOPIC A009000: Solving Simple First Degree Equations
in One Variable

OBJECTIVE A009300: Solving three-step equations

MODEL: $\dfrac{ax}{c} \pm b = d$

x = ?

x ∈ {r,s,t}

$-10 \le a \le 10$ a ≠ 0, ±1, ±7, ±9

$2 \le b,d \le 30$ a ≠ d

$2 \le c \le 10$

EXAMPLES:

A009301 $\dfrac{3s}{4} - 4 = 5$

s = ?   12

A009302 $\dfrac{5r}{5} + 20 = 15$

r = ?   -5

A009303 $\dfrac{-4t}{3} + 15 = 7$

t = ?   6

MODEL: $\dfrac{a(x \pm b)}{c} = d$

x = ?

x ∈ {r,s,t}

$-10 \le a \le 10$ a ≠ 0), ±1, ±7, ±9

$2 \le b,d \le 30$ a ≠ d

$2 \le c \le 10$

OBJECTIVE A009300 (cont'd)

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Mathematics for the Intermediate Division

TOPIC A009000:   Solving Simple First Degree Equations
in One Variable

EXAMPLES:

A009304 $\dfrac{2(r + 4)}{6} = 10$

r = ?   26

A009305 $\dfrac{-8(s - 9)}{3} = 16$

s = ?   3

A009306 $\dfrac{10(t - 7)}{9} = 12$

t = ?   84/5 or 16 4/5

MODEL:

$a(x \pm b) \pm c = d$
x = ?
$x \epsilon \{r,s,t\}$
$-10 \le a \le 10$ $a \ne 0, \pm 1, \pm 7, \pm 9$
$2 \le b,d \le 30$ $a \ne d$
$2 \le c \le 10$

OBJECTIVE A009300 (cont'd)

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<u>Mathematics for the Intermediate Division</u>

TOPIC A009000:   Solving Simple First Degree Equations
                 in One Variable

EXAMPLES: A009307 $4(s + 3) - 7 = 25$

                     $s = ?$ 5

          A009308 $8(r - 7) - 5 = 16$

                     $r = ?$ 77/8 or 9 5/8

          A009309 $6(t - 12) + 8 = 29$

                     $t = ?$ 31/2 or 15 1/2

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Mathematics for the Intermediate Division

TOPIC A009000: Solving Simple First Degree Equations in One Variable

OBJECTIVE A009400: Solving multi-step equations

MODEL: a(c - bx)/d = e
           x = ?
           x ∈ {a,b,c}
           2 ≤ b,c,d ≤ 12
           10 ≤ e ≤ 30
           -12 ≤ a ≤ 12   a ≠ -1,1,0
           a is a factor of e

EXAMPLES:

           A009401   2(9 - 3a)/5 = 6

                       a = ? -2

           A009402   -4(6 - 2b)/3 = 16

                       b = ?   9

           A009403   8(12 - 5c)/7 = 24

                       c = ? -9/5

MODEL: a(bx + c)/d = e
              x = ?
           x {a,b,c}
           2 ≤ b,c,d ≤ 12
           10 ≤ e ≤ 30
           -12 ≤ a ≤ 12   a ≠ -1,1,0
           a is a factor of e

OBJECTIVE A009400 (cont'd)

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Mathematics for the Intermediate Division

TOPIC A009000: Solving Simple First Degree Equations
in One Variable

EXAMPLES:

A009404 $3(5b + 4)/4 = 18$

b = ?   4

A009405 $-4(2a + 2)/10 = 28$

a = ? -36

A009406 $9(7c + 8)/11 = 18$

c = ?   2

MODEL: $a(bx - c)/d = e$
$x = ?$
$x \in \{a,b,c\}$
$2 \leq b,c,d \leq 12$
$10 \leq e \leq 30$
$-12 \leq a \leq 12 \quad a \neq -1,1,0$
a is a factor of e

EXAMPLES:

A009407 $2(4c - 3)/7 = 6$

c = ?   6

A009408 $4(10b - 3)/8 = 24$

b = ?   51/10 or 5 1/10

A009409 $-5(7a - 11)/9 = 25$

a = ?   -34/7 or -4 6/7

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Mathematics for the Intermediate Division

TOPIC A010000: Solving Complex First Degree Equations
                 in One Variable

(a) Reference(s) to the Curriculum Guideline:
     Grade 7
     Grade 8
     Grade 9
     Grade 10

(b) Difficulty Level:
     pre-instruction = .56   post-instruction = .76

OBJECTIVE A010100:   Solving equations with the variable
                     appearing once on each side

MODEL: $ax \pm b = cx + d$
               $x = ?$
            $x \in \{a,b,c,m,n,x\}$
            $-5 \leq a,c \leq 10$ $a,c \neq 0, \; a \neq c$
            $1 \leq b,d \leq 25$

EXAMPLES:

            A010101 $x - 5 = 6x + 10$

                       $x = ?$ -3

            A010102 $4m + 17 = 9m + 8$

                       $m = ?$ $9/5$ or $1 \; 4/5$

            A010103 $-a + 21 = a + 21$

                       $a = ?$ 0

MODEL: $ax \pm b = cx - d$
               $x = ?$
            $x \in \{a,b,c,m,n,x\}$
            $-5 \leq a,c \leq 10$ $a,c \neq 0$ $a \neq c$
            $1 \leq b,d \leq 25$

OBJECTIVE A010100 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC   A010000: Solving Complex First Degree Equations
                 in One Variable

EXAMPLES:

$$\begin{array}{lll}
\text{A010104} & b + 17 = 8b - 4 & \\
& b = ? & 3 \\
\text{A010105} & 8n - 12 = 6n - 6 & \\
& n = ? & 3 \\
\text{A010106} & 7x + 10 = 9x - 13 & \\
& x = ? & 23/2 \text{ or } 11\ 1/2
\end{array}$$

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Mathematics for the Intermediate Division

TOPIC A010000: Solving Complex First Degree Equations
in One Variable

OBJECTIVE A010200: Solving equations with the variable
appearing twice on each side

MODEL: $ax \pm bx \pm c = dx \pm e \pm gx$
$x = ?$
$x \epsilon \{a,b,c,m,n,x\}$
$1 \leq a,b,d,g \leq 15$ $(a + b) \neq (d + g)$
$1 \leq c,e \leq 50$ $c \neq e$

EXAMPLES:

A010201 $2c - 2c - 34 = 5c - 24 + 13c$

$c = ?$ $-5/9$

A010202 $3a + 8a - 47 = 8a + 14 - a$

$a = ?$ $61/4$ or $15 \; 1/4$

A010203 $4x - 5x + 5 = 15x + 33 - 6x$

$x = ?$ $-14/5$ or $-2 \; 4/5$

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Mathematics for the Intermediate Division

TOPIC A010000: Solving Complex First Degree Equations
in One Variable

OBJECTIVE A010300: Solving equations involving brackets

MODEL: $a(x \pm b) + c(x \pm d) = e(x \pm f)$
$x \in \{a, b, c, m, n, x\}$
$-6 \le a, c, e, \le 12 \quad a, c, e \ne o$
$1 \le b, d, f \le 15$
$(a + c) \ne e \qquad a \ne c$

EXAMPLES:

A010301 $(n - 7) - 3(n - 12) = 7(n - 10)$

$n = ? \qquad 11$

A010302 $5(m - 8) + 3(m - 11) = 7(m - 15)$

$m = ? \qquad -32$

A010303 $7(c - 6) - 4(c + 6) = 4(c + 15)$

$c = ? \qquad -126$

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Mathematics for the Intermediate Division

TOPIC A011000: Solving First Degree Equations in One
Variable Involving Rational Expressions

(a) Reference(s) to the Curriculum Guideline:
Grade 7
Grade 8
Grade 9
Grade 10

(b) Difficulty Level:
pre-instruction = .35, post-instruction = .69

OBJECTIVE A011100:   Solving equations with the variable
appearing on the left side

MODEL: $\dfrac{h(ax + b)}{c} \pm \dfrac{i(dx - e)}{f} = g$
x = ?
$x \in \{a,b,m,n,p,q\}$
$1 \le a,b,d,e \le 4$
$2 \le c,f \le 4$ or c = 2f or f = 2c random
$1 \le g \le 5$
$1 \le h,i \le 3$

EXAMPLES:

A011101 $\dfrac{3(2q + 4)}{3} + \dfrac{3(4q - 2)}{4} = 2$

q = ?   -1/10

A011102 $\dfrac{3q + 4}{2} + \dfrac{2(4q - 1)}{3} = 3$

q = ?   2/5

A011103 $\dfrac{3(4n + 3)}{3} + \dfrac{3(4n - 2)}{4} = 5$

n = ?   1/2

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Mathematics for the Intermediate Division

TOPIC A011000: Solving First Degree Equations in One
Variable Involving Rational Expressions

OBJECTIVE A011200: Solving equations with the variable
appearing on both sides

MODEL:

$$\frac{gx - p}{d} \pm \frac{b(x \overset{+}{-} q)}{e} = \frac{c(kx \overset{+}{-} r)}{f}$$

x = ?

$x \in \{a,b,m,n,p,q\}$

$2 \le a,b,c,d,e,f \le 4$ $\qquad c \ne f, \ b \ne e$

$1 \le g,k,p,q,r \le 4$

EXAMPLES:

A011201 $\quad \dfrac{3m - 2}{2} + \dfrac{2(m + 3)}{3} = \dfrac{3(2m - 1)}{4}$

m = ? −21/8 or −2 5/8

A011202 $\quad \dfrac{4a - 2}{2} + \dfrac{4(a + 1)}{2} = \dfrac{2(a + 4)}{3}$

a = ? 1/2

A011203 $\quad \dfrac{3p - 4}{3} - \dfrac{3(p - 2)}{4} = \dfrac{3(2p + 1)}{2}$

p = ? −16/33

MODEL:

$$\frac{a(gx - p)}{d} = \frac{c(kx \overset{+}{-} r)}{f}$$

$x \in \{a,b,m,n,p,q\}$

$2 \le a,c,d,f \le 4$ $\qquad a \ne d \quad c \ne f \quad d \ne f$

$1 \le g,k,p,r \le 4$

OBJECTIVE A011200 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A011000: Solving First Degree Equations in One
Variable Involving Rational Expressions

EXAMPLES:

A011204 $\dfrac{4(2n - 4)}{3} = \dfrac{2(4n + 3)}{4}$

n = ? 41/4 or 10 1/4

A011205 $\dfrac{3(3a - 4)}{2} = \dfrac{2(3a - 2)}{3}$

a = ? 28/15 or 1 13/15

A011206 $\dfrac{2(4b - 1)}{3} = \dfrac{3(3b + 2)}{4}$

b = ? 26/5 or 5 1/5

MODEL: $\dfrac{a(gx - p)}{d} \pm \dfrac{q}{e} = \dfrac{c(kx \overset{+}{-} r)}{f}$

x = ?

$x \in \{a,b,m,n,p,q, \}$
$2 \leq a,c,d,e,f \leq 4$
$1 \leq g,k,p,q,r \leq 4$
$a \neq d \quad c \neq f \quad q \neq e \quad d \neq e$

EXAMPLES:

A011207 $\dfrac{3(4n - 2)}{2} - \dfrac{1}{4} = \dfrac{2(n + 3)}{4}$

n = ? 19/22

A011208 $\dfrac{2(3m - 1)}{3} + \dfrac{3}{2} = \dfrac{3(2m + 4)}{4}$

m = ? 13/3 or 4 1/3

A011209 $\dfrac{3(2b + 3)}{2} - \dfrac{2}{3} = \dfrac{3(3b - 2)}{4}$

b = ? -64/9 or -7 1/9

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Mathematics for the Intermediate Division

TOPIC A012000: Using Formulae

(a) Reference(s) to the Curriculum Guideline:
      Grade 7
      Grade 8
      Grade 9
      Grade 10

(b) Difficulty Level:
      pre-instruction = .38 post-instruction .80

OBJECTIVE A012100:   Substituting in a formula to find
                     the variable on the left

MODEL: Use A = lw to find A if l = x, w = y
              A = ?
           $1 \leq x, y \leq 10$, x > y

EXAMPLES:

           A012101   Use A = lw to find A if l = 6, w = 2
                         A = ? 12

           A012102   Use A = lw to find A if l = 5, w = 4
                         A = ? 20

           A012103   Use A = lw to find A if l = 10, w = 9
                         A = ? 90

MODEL: Use P = 2(l + w) to find P if l = x, w = y
              P = ?
           $1 \leq x, y \leq 10$ x > y

EXAMPLES:

           A012104   Use P = 2(l + w) to find P if l = 8, w = 3
                         P = ?   22

           A012105   Use P = 2(l + w) to find P if l = 9, w = 6
                         P = ?   30

           A012106   Use P = 2(l + w) to find P if l = 10, w =
                         P = ?   36

OBJECTIVE A012100 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC A012000:   Using Formulae

MODEL: Use $A = bh/2$ to find A if b = x, h = y
            A = ?
            $1 \leq x, y \leq 10$

EXAMPLES:

        A012107   Use $A = bh/2$ to find A if b = 8, h = 5

                     A = ?   20

        A012108   Use $A = bh/2$ to find A if b = 10, h = 6

                     A = ?   30

        A012109   Use $A = bh/2$ to find A if b = 10, h = 10

                     A = ?   50

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<u>Mathematics for the Intermediate Division</u>

TOPIC A012000: Using Formulae

OBJECTIVE A012200: Substituting in a formula to find
                    any specific variable

MODEL: Use A = bh/2 to find b if A = x, h = y
               b = ?
           x∈{8,12,16,20,24,32,36,40,48,60,72,81,90,100}
           1 ≤ y ≤ 12

EXAMPLES:

           A012201   Use a = bh/2 to find b if A = 40, h = 1

                          b = ? 80

           A012202   Use A = bh/2 to find b if A = 72, h = 6

                          b = ? 24

           A012203   Use A = bh/2 to find b if A = 60, h = 5

                          b = ? 24

MODEL: Use A = lw to find l if A = x, w = y
               l = ?
           x∈{8,12,16,20,24,32,36,40,48,60,72,81,90,100}
           1 ≤ y ≤ 12, $\frac{x}{y}$ > y

EXAMPLES:

           A012204   Use A = lw to find l if A = 12, w = 3

                          l = ? 4

           A012205   Use A = lw to find l if A = 48, w= 6

                          l = ? 8

           A012206   Use A = lw to find l if A = 90, w = 9

                          l = ? 10

OBJECTIVE A012200 (cont'd)

Ontario Assessment Instrument Pool

TOPIC A012000: Using Formulae

MODEL: Use P = 2(l + w) to find w if P = x, l = y
               w = ?
           x ∈ {8,12,16,20,24,32,36,40,48,60,72,81,90,100}
           1 ≤ y ≤ 12

EXAMPLES:

          A012207   Use P = 2(l + w) to find w

                     if P = 24, l = 10

                     w = ?   2

          A012208   Use P = 2(l + w) to find w

                     if P = 40, l = 12

                     w = ?   8

          A012209   Use P = 2(l + w) to find w

                     if P = 36, l = 11

                     w = ?   7

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TOPIC A012000: Using Formulae

OBJECTIVE A012300: Solving a formula for any
specific variable

MODEL: Rearrange the formula A = bh/2 as x = ?
$x \in \{b,h\}$

EXAMPLES:

    A012301   Rearrange the formula
                A = bh/2 as h = ?   2A/b

    A012302   Rearrange the formula
                A = bh/2 as b = ?   2A/h

MODEL: Rearrange the formula S = (a + b)/2 as x = ?
$x \in \{a,1\}$

EXAMPLES:

    A012303   Rearrange the formula
                S = (a + b)/2 as a = ?   2S - b

    A012304   Rearrange the formula
                S = (a + b)/2 as b = ?   2S - a

MODEL: Rearrange the formula V = lwh as x = ?
$x \in \{l,w,h\}$

EXAMPLES:

    A012305   Rearrange the formula
$$V = lwh \text{ as } l = ? \quad \frac{V}{wh}$$

    A012306   Rearrange the formula
$$V = lwh \text{ as } w = ? \quad \frac{V}{lh}$$

    A012307   Rearrange the formula
$$V = lwh \text{ as } h = ? \quad \frac{V}{wl}$$

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A013000: Learning About Probability

(a) Reference(s) to the Curriculum Guideline:
     Grade 7
     Grade 8   A 3a
     Grade 9 Adv   A 6b
              Gen   A 4a
              Basic A 3a
              Mod   N 9a (Courses A,B)
     Grade 10 Adv   A 4b
              Mod   N 9b (Courses B,C)

(b) Difficulty Level:
     pre-instruction = .18, post-instruction = .63

OBJECTIVE A013100: Listing outcomes for simple events

MODEL: . A prize is picked from a group of x different
           prizes. What is the total number of things that
           can happen (outcomes)?

                  $2 \leq x \leq 10$

EXAMPLES:

           A013101   A prize is picked from a group of 3
                      different prizes. What is the total
                      number of things that can happen
                      (outcomes)?   3

           A013102   A prize is picked from a group of 5
                      different prizes. What is the total
                      number of things that can happen
                      (outcomes)?   5

           A013103   A prize is picked from a group of 9
                      different prizes.   What is the total
                      number of things that can happen
                      (outcomes)?   9

OBJECTIVE A013100 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC A013000: Learning About Probability

MODEL: A T-shirt is drawn from a drawer containing x
         different coloured T-shirts. What is the total
         number of things that can happen (outcomes)?

              $2 \leq x \leq 10$

EXAMPLES:

         A013104   A T-shirt is drawn from a drawer con-
                   taining 3 different coloured T-shirts.
                   What is the total number of things that
                   can happen (outcomes)?   3

         A013105   A T-shirt is drawn from a drawer con-
                   taining 6 different coloured T-shirts.
                   What is the total number of things that
                   can happen (outcomes)   6

         A013106   A T-shirt is drawn from a drawer con-
                   taining 7 different coloured T-shirts.
                   What is the total number of things that
                   can happen (outcomes)?   7

MODEL: What is the number of possible outcomes when
         tossing a(n) [object]?

              object ϵ {coin, die, loaded die}

EXAMPLES:

         A013107   What is the number of possible outcomes
                   when tossing a coin?   2

         A013108   What is the number of possible outcomes
                   when tossing a die?   6

         A013109   What is the number of possible outcomes
                   when tossing a loaded die?   1

OBJECTIVE A013100 (cont'd)

Mathematics for the Intermediate Division

TOPIC A013000: Learning About Probability

OBJECTIVE A013200: Listing outcomes for more complicated events

MODEL: What are all the things that can possibly happen when a piece of fruit is chosen from a basket containing x apples (A_1, A_2, A_3,...) and 2 pears (P_1, P_2, P_3,...)?

$$2 \leq x, y \leq 10$$

EXAMPLES:

A013201 What are all the things that can possibly happen when a piece of fruit is chosen from a basket containing 1 apple (A1) and 2 pears (P_1, P_2)? A_1, P_1, P_2

A013202 What are all the things that can possibly happen when a piece of fruit is chosen from a basket containing 2 apples (A_1, A_2) and 3 pears (P_1, P_2, P_3)? A_1, A_2, P_1, P_2, P_3

A013203 What are all the things that can possibly happen when a piece of fruit is chosen from a basket containing 3 apples (A_1, A_2, A_3) and 2 pears (P_1, P_2)? A_1, A_2, A_3, P_1, P_2

OBJECTIVE A013200 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A013000: Learning About Probability

MODEL: What are all the things that can possibly happen
           when a puppy is chosen from a litter of x (P_1, P_2,
           P_3,...)?

                    $2 \leq x \leq 10$

EXAMPLES:

           A013204   What are all the things that can possibly
                      happen when a puppy is chosen from a
                      litter of 3 (P_1, P_2, P_3)? P_1, P_2, P_3
           A013205   What are all the things that can possibly
                      happen when a puppy is chosen from a
                      litter of 5 (P_1, P_2, P_3, P_4, P_5)? P_1, P_2,
                      P_3, P_4, P_5
           A013206   What are all the things that can possibly
                      happen when a puppy is chosen from a
                      litter of 2 (P_1, P_2)? P_1, P_2

MODEL: What are all the things that can possibly happen
           when a straw is drawn from a bunch of x long
           straws (L_1, L_2, L_3,...) and y short straws (S_1, S_2,
           S_3,...)?

                    $2 \leq x,y \leq 10$

OBJECTIVE A013200 (cont'd)

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Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A013000: Learning About Probability

EXAMPLES:

A013207   What are all the things that can possibly happen when a straw is drawn from a bunch of 2 long straws (L_1, L_2) and 3 short straws (S_1, S_2, S_3)? L_1, L_2, S_1, S_2, S_3

A013208   What are all the things that can possibly happen when a straw is drawn from a bunch of 2 long straws (L_1, L_2) and 2 short straws (S_1, S_2)? L_1, L_2, S_1, S_2

A013209   What are all the things that can possibly happen when a straw is drawn from a bunch of 4 long straws (L_1, L_2, L_3, L_4) and 3 short straws (S_1, S_2, S_3)? L_1, L_2, L_3, L_4, S_1, S_2, S_3

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC A013000: Learning About Probability

OBJECTIVE A013300:   Finding the number of outcomes for two
                     events

MODEL: An extremely tiny country issues license plates
            which have only 1 letter followed by 1 digit. How
            many possible license plates are there if they use
            x different digits and y different letters?

                 $2 \leq x \leq 10$ $2 \leq y \leq 26$

EXAMPLES:

        A013301   An extremely tiny country issues license
                   plates which have only 1 letter followed
                   by 1 digit. How many possible license
                   plates are there if they use 5 different
                   digits and 10 different letters?   50

        A013302   An extremely tiny country issues license
                   plates which have only 1 letter followed
                   by 1 digit. How many possible license
                   plates are there if they use 8 different
                   digits and 15 different letters?   120

        A013303   An extremely tiny country issues license
                   plates which have only 1 letter followed
                   by 1 digit. How many possible license
                   plates are there if they use 10 differen
                   digits and 26 different letters?   260

OBJECTIVE A013300 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC A013000: Learning About Probability

MODEL: A restaurant lists x main courses and y desserts.
           How many possible main course-dessert choices are
           there?

$$3 \leq x,y \leq 7$$

EXAMPLES:

        A013304   A restaurant lists 3 main courses and 4

                   desserts. How many possible main course-

                   dessert choices are there?   12

        A013305   A restaurant lists 4 main courses and 5

                   desserts. How many possible main course-

                   dessert choices are there?   20

        A013306   A restaurant lists 5 main courses and 6

                   desserts. How many possible main course-

                   dessert choices are there?   30

MODEL: A jar contains one ball each of x different
           colours. If you choose one ball, replace it and
           then choose another, what is the total number of
           possible outcomes for the two draws together?

$$2 \leq x \leq 6$$

OBJECTIVE A013300 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC A013000: Learning About Probability

EXAMPLES:

A013307   A jar contains one ball each of 3
          different colours. If you choose one
          ball, replace it and then choose another,
          what is the total number of possible
          outcomes for the two draws together?   9

A013308   A jar contains one ball each of 2
          different colours. If you choose one
          ball, replace it and then choose
          another, what is the total number of
          possible outcomes for the two draws
          together?   4

A013309   A jar contains one ball each of 4
          different colours. If you choose one
          ball, replace it and then choose
          another, what is the total number of
          possible outcomes for the two draws
          together?   16

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A013000: Learning About Probability

OBJECTIVE A013400:   Finding the number of outcomes for three
                     or more events

MODEL: At a make your own sandwich bar there are x kinds
            of bread, y meats, and z garnishes. If you can
            choose one bread, one meat, and one garnish, how
            many different sandwiches could you make?

$$2 \leq x,y,z \leq 5$$

EXAMPLES:

A013401   At a make your own sandwich bar there
           are 2 kinds of bread, 3 meats, and 2
           garnishes. If you can choose one bread,
           one meat, and one garnish, how many
           different sandwiches could you make?
           12

A013402   At a make your own sandwich bar there
           are 3 kinds of bread, 3 meats, and 3
           garnishes. If you can choose one bread,
           one meat, and one garnish, how many
           different sandwiches could you make?
           27

A013403   At a make your own sandwich bar there
           are 3 kinds of bread, 4 meats, and 2
           garnishes. If you can choose one bread,
           one meat, and one garnish, how many
           different sandwiches could you make?
           24

OBJECTIVE A013400 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC A013000: Learning About Probability

MODEL: A small country issues license plates which have
         only 1 letter followed by 2 digits. How many
         possible license plates are there if you use x
         different letters and y different digits?

                2 ≤ x ≤ 26   2 ≤ y ≤ 10

EXAMPLES:

       A013404   A small country issues license plates
                 which have only 1 letter followed by 2
                 digits. How many possible license
                 plates are there if you use 10 different
                 letters and 6 different digits?   360

       A013405   A small country issues license plates
                 which have only 1 letter followed by 2
                 digits. How many possible license
                 plates are there if you use 18 different
                 letters and 5 different digits?   450

       A013406   A small country issues license plates
                 which have only 1 letter followed by 2
                 digits. How many possible license
                 plates are there if you use 26 different
                 letters and 10 different digits?   2600

MODEL: What is the total number of possible outcomes when
         x dice are tossed together?

                2 ≤ x ≤ 5

OBJECTIVE A013400 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC A013000: Learning About Probability

EXAMPLES:

A013407   What is the total number of possible
           outcomes when 2 dice are tossed to-
           gether?   36

A013408   What is the total number of possible
           outcomes when 3 dice are tossed to-
           gether?   216

A013409   What is the total number of possible
           outcomes when 4 dice are tossed to-
           gether?   1296

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-
                Outcome Experiments

(a) Reference(s) to the Curriculum Guideline:
     Grade 7
     Grade 8   A 3a
     Grade 9 Adv   A 4b
              Gen   A 4a
              Basic A 3a
              Mod   N 9a (Courses A,B)
     Grade 10 Adv   A 4b
              Mod   N 9b (Courses B,C)

(b) Difficulty Level:
     pre-instruction = .66, post-instruction = .84

OBJECTIVE A014100: Finding the number of favourable outcomes
                    in a simple experiment

MODEL: A wallet contains x one-dollar bills and a grocery
          list. If you want to pick a bill, how many outcome
          are favourable?

                    $2 \leq x \leq 10$

OBJECTIVE A014100 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-
Outcome Experiments

EXAMPLES:

A014101   A wallet contains 2 one-dollar bills and
a grocery list. If you want to pick a
bill, how many outcomes are favourable?
2

A014102   A wallet contains 7 one-dollar bills and
a grocery list. If you want to pick a
bill, how many outcomes are favourable?
7

A014103   A wallet contains 10 one-dollar bills
and a grocery list. If you want to pick
a bill, how many outcomes are favourable?
10

MODEL: A T-shirt is picked from a drawer containing x
blue T-shirts and y red T-shirts. If you want to
pick a [name] T-shirt, how many outcomes are
favourable?

Name ϵ {blue, red}

$2 \leq x, y \leq 10$

OBJECTIVE A014100 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-
                Outcome Experiments

EXAMPLES:

A014104   A T-shirt is picked from a drawer
            containing 2 blue T-shirts and 4 red
            T-shirts. If you want to pick a red
            T-shirt, how many outcomes are
            favourable?   4

A014105   A T-shirt is picked from a drawer contain:
            3 blue T-shirts and 5 red T-shirts. If
            you want to pick a blue T-shirt, how
            many outcomes are favourable?   3

A014106   A T-shirt is picked from a drawer
            containing 7 blue T-shirts and 7 red
            T-shirts. If you want to pick a blue
            T-shirt, how many outcomes are
            favourable?   7

MODEL: A straw is drawn from a bunch of x long straws and
          1 short straw. If you want to pick a [name] straw,
          how many outcomes are favourable?

                Name ϵ {short, long}

                $2 \le x \le 12$

OBJECTIVE A014100 (cont'd)

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-
Outcome Experiments

EXAMPLES:

A014107   A straw is drawn from a bunch of 8 long
straws and 1 short straw. If you want
to pick a short straw, how many outcomes
are favourable?   1

A014108   A straw is drawn from a bunch of 5 long
straws and 1 short straw. If you want
to pick a long straw, how many outcomes
are favourable?   5

A014109   A straw is drawn from a bunch of 10 long
straws and 1 short straw. If you want
to pick a long straw, how many outcomes
are favourable?   10

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-Outcome Experiments

OBJECTIVE A014200: Finding whether the chances of winning are greater than losing in a simple experiment

MODEL: A ball will be drawn from a jar containing x red balls and y white balls. If a [name] ball is drawn you win, otherwise you lose. Are your chances of winning better than your chances of losing? Answer yes or no.

Name ϵ {red, white}

$10 \leq x,y \leq 50$

OBJECTIVE A014200 (cont'd)

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-
        Outcome Experiments

EXAMPLES:

A014201   A ball will be drawn from a jar contain-
           ing 10 red balls and 7 white balls. If
           a white ball is drawn you win, otherwise
           you lose. Are your chances of winning
           better than your chances of losing?
           Answer yes or no.   No

A014202   A ball will be drawn from a jar contain-
           ing 19 red balls and 14 white balls. If
           a red ball is drawn you win, otherwise
           you lose. Are your chances of winning
           better than your chances of losing?
           Answer yes or no.   Yes

A014203   A ball will be drawn from a jar containing
           28 red balls and 28 white balls. If a
           red ball is drawn you win, otherwise you
           lose. Are your chances of winning better
           than your chances of losing? Answer yes
           or no.   No

OBJECTIVE A014200 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-
Outcome Experiments

MODEL: A raffle is being held. A total of x tickets have
been sold. You got carried away, and bought y of
the tickets. A ticket stub is drawn from the
barrel containing the x stubs. If one of your
stubs is drawn you win the grand prize, otherwise
you lose. Are your chances of winning better than
your chances of losing? Answer yes or no.

$$50 \leq x \leq 200$$

$$0.3x \leq y \leq 0.7x$$

OBJECTIVE A014200 (cont'd)

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-
Outcome Experiments

EXAMPLES:

A014204   A raffle is being held. A total of 100
tickets have been sold. You got carried
away, and bought 48 of the tickets. A
ticket stub is drawn from the barrel
containing the 100 stubs. If one of your
stubs is drawn you win the grand prize,
otherwise you lose. Are your chances of
winning better than your chances of
losing? Answer yes or no.   No

A014205   A raffle is being held. A total of 157
tickets have been sold. You got carried
away, and bought 94 of the tickets. A
ticket stub is drawn from the barrel
containing the 157 stubs. If one of
your stubs is drawn you win the grand
prize, otherwise you lose. Are your
chances of winning better than your
chances of losing? Answer yes or no.   Yes

A014206   A raffle is being held. A total of 195
tickets have been sold. You got carried
away, and bought 97 of the tickets. A
ticket stub is drawn from the barrel
containing the 195 stubs. If one of your
stubs is drawn you win the grand prize,
otherwise you lose. Are your chances of
winning better than your chances of
losing? Answer yes or no.   No

OBJECTIVE A014200 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-
Outcome Experiments

MODEL: A single die is rolled. If x is rolled you win,
otherwise you lose. Are your chances of winning
better than your chances of losing? Answer yes or
no.

$$2 \leq x \leq 6$$

EXAMPLES:

A014207   A single die is rolled. If 2 is rolled
you win, otherwise you lose. Are your
chances of winning better than your
chances of losing? Answer yes or no. No

A014208   A single die is rolled. If 5 is rolled
you win, otherwise you lose. Are your
chances of winning better than your
chances of losing? Asnwer yes or no. No

A014209   A single die is rolled. If 4 is rolled
you win, otherwise you lose. Are your
chances of winning better than your
chances of losing? Answer yes or no.   No

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-Outcome Experiments

OBJECTIVE A014300: Using the definition of probability to calculate probabilities

MODEL: A bowl contains x green grapes and y purple grapes. What is the probability of drawing a [name] grape, given that the number of favourable outcomes is n, and the total number of outcomes is x + y?

Name ϵ {green, purple}

n ϵ{x,y} $10 \leq x,y \leq 25$

EXAMPLES:

A014301   A bowl contains 14 green grapes and 13 purple grapes. What is the probability of drawing a purple grape, given that the number of favourable outcomes is 13, and the total number of outcomes is 14 + 13?   13/27

A014302   A bowl contains 17 green grapes and 18 purple grapes. What is the probability of drawing a green grape, given that the number of favourable outcomes is 17, and the total number of outcomes is 17 + 18? 17/35

A014303   A bowl contains 20 green grapes and 20 purple grapes. What is the probability of drawing a green grape, given that the number of favourable outcomes is 20, and the total number of outcomes is 20 + 20? 1/2

OBJECTIVE A014300 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-
            Outcome Experiments

MODEL: A wallet contains x one-dollar bills and a grocery
            list. What is the probability of pulling out a
            [name], given that the number of favourable
            outcomes is n, and the total number of outcomes
            is x + 1?

                    Name $\in$ {bill, list}

                    $n \in$ {x,1} $2 \leq x \leq 10$

EXAMPLES:

     A014304   A wallet contains 2 one-dollar bills and
                   a grocery list. What is the probability
                   of pulling out a list, given that the
                   number of favourable outcomes is 1, and
                   the total number of outcomes is 2 + 1?
                   1/3

     A014305   A wallet contains 7 one-dollar bills and
                   a grocery list. What is the probability
                   of pulling out a bill, given that the
                   number of favourable outcomes is 7, and
                   the total number of outcomes is 7 + 1?
                   7/8

     A14306   A wallet contains 8 one-dollar bills and
                   a grocery list. What is the probability
                   of pulling out a list, given that the
                   number of favourable outcomes is 1, and
                   the total number of outcomes is 8 + 1?
                   1/9

OBJECTIVE A014300 (cont'd)

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-
Outcome Experiments

MODEL: A box has x tickets, including 1 which is yours.
What is the probability of your ticket being
chosen, given that the number of favourable
outcomes is 1, and the total number of outcomes
is x?

$$5 \leq x \leq 50$$

EXAMPLES:

A014307   A box has 7 tickets, including 1 which
is yours. What is the probability of
your ticket being chosen, given that the
number of favourable outcomes is 1, and
the total number of outcomes is 7?   1/7

A14308   A box has 18 tickets, including 1 which
is yours. What is the probability of
your ticket being chosen, given that the
number of favourable outcomes is 1, and
the total number of outcomes is 18? 1/18

A014309   A box has 49 tickets, including 1 which
is yours. What is the probability of
your ticket being chosen, given that the
number of favourable outcomes is 1, and
the total number of outcomes is 49?
1/49

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-Outcome Experiments

OBJECTIVE A014400: Finding the probabilities of certain and impossible events

MODEL: A jar contains x white jelly beans and y pink jelly beans. If a bean is drawn from the jar, what is the probability that it is a jelly bean?

$$5 \leq x,y \leq 20$$

EXAMPLES:

A014401   A jar contains 20 white jelly beans and 12 pink jelly beans. If a bean is drawn from the jar, what is the probability that it is a jelly bean?   1

A014402   A jar contains 11 white jelly beans and 11 pink jelly beans. If a bean is drawn from the jar, what is the probability that it is a jelly bean?   1

A014403   A jar contains 17 white jelly beans and 20 pink jelly beans. If a bean is drawn from the jar, what is the probability that it is a jelly bean?   1

MODEL: A bead is drawn from a jar containing x red beads. What is the probability of drawing a blue bead?

$$2 \leq x \leq 10$$

OBJECTIVE A014400 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-
Outcome Experiments

EXAMPLES:

A014404   A bead is drawn from a jar containing 3
red beads. What is the probability of
drawing a blue bead?   0

A014405   A bead is drawn from a jar containing 6
red beads. What is the probability of
drawing a blue bead?   0

A014406   A bead is drawn from a jar containing 10
red beads. What is the probability of
drawing a blue bead?   0

MODEL: A card is drawn from a set of cards consisting of
x hearts. What is the probability of drawing a
[name]?

Name $\in$ {heart, club, spade, diamond}

$5 \leq x \leq 20$

EXAMPLES:

A014407   A card is drawn from a set of cards
consisting of 8 hearts. What is the
probability of drawing a club?   0

A014408   A card is drawn from a set of cards
consisting of 14 hearts. What is the
probability of drawing a heart?   1

A014409   A card is drawn from a set of cards
consisting of 20 hearts. What is the
probability of drawing a diamond? 0

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-
Outcome Experiments

OBJECTIVE A014500: Solving simple probability problems

MODEL: A T-shirt is picked from a drawer containing x
blue T-shirts and y red T-shirts. What is the
probability of picking a [name] T-shirt?

Name ϵ {red, blue}

2 ≤ x,y ≤ 10

EXAMPLES:

A014501   A T-shirt is picked from a drawer
containing 5 blue T-shirts and 5 red
T-shirts. What is the probability of
picking a red T-shirt?   1/2

A014502   A T-shirt is picked from a drawer
containing 2 blue T-shirts and 6 red
T-shirts. What is the probability of
picking a blue T-shirt? 1/4

A014503   A T-shirt is picked from a drawer
containing 8 blue T-shirts and 12 red
T-shirts. What is the probability of
picking a red T-shirt?   3/5

MODEL: Mitzy and her sisters are all identical [name] whom
you can never tell apart. You go to Mitzy (you
hope) and tell her that you can bring the paper
hats for the surprise party for Mom. What is the
probability that you have actually picked the right
[name] (Mitzy)?

Name ϵ {twin(s), triplet(s), quadruplet(s)}

OBJECTIVE A014500 (cont'd)

Mathematics for the Intermediate Division

TOPIC A014000: Determining Probabilities in Simple Two-
Outcome Experiments

EXAMPLES:

A014504   Mitzy and her sisters are all identical
twins whom you can never tell apart. You
go to Mitzy (you hope) and tell her that
you can bring the paper hats for the
surprise party for Mom. What is the
probability that you have actually picked
the right twin (Mitzy)? 1/2

A014505   Mitzy and her sisters are all identical
triplets whom you can never tell apart.
You go to Mitzy (you hope) and tell her
that you can bring the paper hats for
the surprise party for Mom. What is the
probability that you have actually picked
the right triplet (Mitzy)?   1/3

A014506   Mitzy and her sisters are all identical
quadruplets whom you can never tell
apart. You go to Mitzy (you hope) and
tell her that you can bring the paper
hats for the surprise party for Mom.
What is the probability that you have
actually picked the right quadruplet
(Mitzy)? 1/4

OBJECTIVE A014500 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC A014000: Determining Probabilities in Simple Two-
              Outcome Experiments

MODEL: A litter of puppies contains x all black puppies
            and y white puppies with black spots. Since
            they are all so cute, you close your eyes and pick
            a puppy randomly. What is the probability that
            you have picked [name] puppy?

                    Name ϵ {an all black, a spotted}

                    2 $\leq$ x,y $\leq$ 4

EXAMPLES:

      A014507   A litter of puppies contains 4 all black
                 puppies and 2 white puppies with black
                 spots. Since they are all so cute, you
                 close your eyes and pick a puppy randomly.
                 What is the probability that you have
                 picked an all black puppy?   2/3

      A014508   A litter of puppies contains 3 all black
                 puppies and 4 white puppies with black
                 spots. Since they are all so cute, you
                 close your eyes and pick a puppy randomly.
                 What is the probability that you have
                 picked a spotted puppy?   4/7

      A014509   A litter of puppies contains 2 all black
                 puppies and 3 white puppies with black
                 spots. Since they are all so cute, you
                 close your eyes and pick a puppy randomly.
                 What is the probability that you have
                 picked an all black puppy?   2/5

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Mathematics for the Intermediate Division

TOPIC A015000: Determining Probabilities in Multi-Outcome
Experiments

(a) Reference(s) to the Curriculum Guideline:
     Grade 7
     Grade 8
     Grade 9 Adv   A 6a
              Basic A 3a
     Grade 10 Adv   A 4b
              Mod   A 9e (Course C)

(b) Difficulty Level:
     pre-instruction = .66, post-instruction = .89

OBJECTIVE A015100: Finding the probabilities in simple
                    experiments with more than two outcomes

MODEL: What is the probability of rolling a x with a
           single die?

$$1 \leq x \leq 6$$

EXAMPLES:

          A015101   What is the probability of rolling a 5
                    with a single die?   1/6

          A015102   What is the probability of rolling a 2
                    with a single die?   1/6

          A015103   What is the probability of rolling a 6
                    with a single die?   1/6

MODEL: A wallet contains a one-dollar bills, b ten-dollar
           bills and a phone bill. If you pick a bill randomly,
           what is the probability that it is a [name] bill?

           Name ϵ {one-dollar, ten dollar, phone}

           $$2 \leq a \leq 5$$

           $$2 \leq b \leq 3$$

OBJECTIVE A015000 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A015000: Determining Probabilities in Milti-Outcome
Experiments

EXAMPLES:

A015104   A wallet contains 2 one-dollar bills, 2
ten-dollar bills and a phone bill. If
you pick a bill randomly, what is the
probability that it is a one-dollar
bill?   2/5

A015105   A wallet contains 3 one-dollar bills,
2 ten-dollar bills and a phone bill. If
you pick a bill randomly, what is the
probability that it is a ten-dollar
bill?   1/3

A015106   A wallet contains 5 one-dollar bills, 3
ten-dollar bills and a phone bill. If
you pick a bill randomly, what is the
probability that it is a one-dollar
bill?   5/9

MODEL: A florist has carnations in 5 colours x white, y
red, z yellow, w pink and v blue. A customer asks
for a carnation and says that the colour does not
matter. What is the probability that he will get a
[name] carnation?

Name $\in$ {white, red, yellow, pink, blue}

$2 \leq x, y, z, w, v \leq 10$

OBJECTIVE A015100 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A015000: Determining Probabilities in Milti-Outcome
            Experiments

EXAMPLES:

      A015107   A florist has carnations in 5 colours: 7
               white, 6 red, 9 yellow, 7 pink and 5
               blue. A customer asks for a carnation
               and says that the colour does not matter.
               What is the probability that he will get
               a pink carnation?   7/34

      A015108   A florist has carnations in 5 colours:
               4 white, 7 red, 8 yellow, 6 pink and 3
               blue. A customer asks for a carnation
               and says that the colour does not matter.
               What is the probability that he will get
               a blue carnation ? 3/28

      A015109   A florist has carnations in 5 colours: 9
               white, 4 red, 4 yellow, 3 pink and 8
               blue. A customer asks for a carnation
               and says that the colour does not matter.
               What is the probability that he will get
               a yellow carnation?   1/7

OBJECTIVE A015200: Finding the probabilities in complex
                   experiments with more than two outcomes

MODEL: A pair of dice is rolled. What is the probability
         of rolling a x and a y?

$$1 \leq x, y \leq 6$$

OBJECTIVE A15200 (cont'd)

Mathematics for the Intermediate Division

TOPIC A015000: Determining Probabilities in Milti-Outcome
Experiments

EXAMPLES:

A015201   A pair of dice is rolled. What is the
probability of rolling a 6 and a 6? 1/36

A015202   A pair of dice is rolled. What is the
probability of rolling a 5 and a 3? 1/18

A015203   A pair of dice is rolled. What is the
probability of rolling a 4 and a 5? 1/18

MODEL: If it is equally likely that a child will be a boy
or girl, what is the probability that a family
with 2 children will have x boy(s) and y girl(s)?

$$0 \leq x,y \leq 2 \qquad\qquad x + y = 2$$

EXAMPLES:

A015204   If it is equally likely that a child
will be a boy or girl, what is the
probability that a family with 2 children
will have 1 boy and 1 girl? 1/2

A015205   If it is equally likely that a child
will be a boy or girl, what is the
probability that a family with 2 children
will have 2 boys and 0 girl? 1/4

A015206   If it is equally likely that a child
will be a boy or girl, what is the
probability that a family with 2 children
will have 0 boy and 2 girls? 1/4

MODEL: If you toss y coins, what is the probability of
tossing at least x tail(s)?

$$0 \leq x,y \leq 3 \qquad\qquad x \leq y$$

OBJECTIVE A015200 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A015000: Determining Probabilities in Milti-Outcome
Experiments

EXAMPLES:

A015207   If you toss two coins, what is the
probability of tossing at least 1
tail(s)? 3/4

A015208   If you toss three coins, what is the
probability of tossing at least 2
tail(s)? 3/8

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC A016000: Expressing Percentage Probabilities
                as Fractional Probabilities

(a) Reference(s) to the Curriculum Guideline:
     Grade 7
     Grade 8
     Grade 9 Adv   A 6b
     Grade 10 Adv   A 4b
              Mod   N 9e (Course C)

(b) Difficulty Level:
     pre-instruction = .29, post-instruction = .84

OBJECTIVE A016100: Converting percentage probabilities to
                    fractional probabilities

MODEL: The probability that 2 people in a group of x will
           have the same birthday is about y%. What is the
           probability expressed as a common fraction?

                $(x,y) \in \{(20,40), (30,70), (35,80), (40,90)\}$

EXAMPLES:

           A016101   The probability that 2 people in a group
                      of 20 will have the same birthday is about
                      40%. What is the probability expressed as
                      a common fraction? 2/5
           A016102   The probability that 2 people in a group
                      of 30 will have the same birthday is about
                      70%. What is the probability expressed as
                      a common fraction? 7/10
           A016103   The probability that 2 people in a group
                      of 40 will have the same birthday is about
                      90%. What is the probability expressed as
                      a common fraction? 9/10

OBJECTIVE A016100 (cont'd)

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Mathematics for the Intermediate Division

TOPIC A016000: Expressing Percentage Probabilities
as Fractional Probabilities

MODEL: The weather report says that the probability of
rain today is about x%. What is the probability
that it will rain, expressed as a common fraction?

$$x = 5a \qquad 1 \le a \le 19$$

EXAMPLES:

A016104   The weather report says that the probability
of rain today is about 85%. What is the
probability that it will rain, expressed
as a common fraction?   17/20

A016105   The weather report says that the probability
of rain today is about 45%. What is the
probability that it will rain, expressed
as a common fraction?   9/20

A016106   The weather report says that the probability
of rain today is about 5%. What is the
probability that it will rain, expressed
as a common fraction?   1/20

MODEL: You must choose from among x boxes which have been
set up so that you have a y% chance of choosing a
"good" prize. What is the probability of choosing
a "good" prize, expressed as a common fraction?

$$x \in \{2,4,5,10\} \qquad 1 \le a \le x-1 \qquad y = a/x \times 100\%$$

OBJECTIVE A016100 (cont'd)

Ontario Assessment Instrument Pool

<u>Mathematics for the Intermediate Division</u>

TOPIC A016000: Expressing Percentage Probabilities
as Fractional Probabilities

EXAMPLES:

A016107   You must choose from among 2 boxes which
have been set up so that you have a 50%
chance of choosing a "good" prize. What
is the probability of choosing a "good"
prize, expressed as a common fraction?
1/2

A016108   You must choose from among 5 boxes which
have been set up so that you have a 60%
chance of choosing a "good" prize. What
is the probability of choosing a "good"
prize, expressed as a common fraction?
3/5

A016109   You must choose from among 10 boxes which
have been set up so that you have a 20%
chance of choosing a "good" prize. What
is the probability of choosing a "good"
prize, expressed as a common fraction?
1/5

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A017000: Determining Odds

(a) Reference(s) to the Curriculum Guideline:
     Grade 7
     Grade 8
     Grade 9 Adv   A 6b
     Grade 10 Adv   A 4b
              Mod   A 9e (Course C)

(b) Difficulty Level:
     pre-instruction = .16, post-instruction = .58

OBJECTIVE A017100: Finding the "Odds in Favour" and "Odds
                    Against" in simple experiments

MODEL: A jar contains x black balls and y white balls.
           What are the odds [type] picking out a [name] ball
           given that the number of favourable outcomes is n
           and the total number of outcomes is x+y?

               Type ϵ {in favour of, against}
               Name ϵ {white, black}

               $n \epsilon \{x,y\}$ $2 \leq x, y \leq 10$

OBJECTIVE A017100 (cont'd)

Ontario Assessment Instrument Pool

TOPIC A017000: Determining Odds

EXAMPLES:

A017101   A jar contains 6 black balls and 4 white
            balls. What are the odds in favour of
            picking out a white ball given that the
            number of favourable outcomes is 4 and the
            total number of outcomes is 10?   2/3

A017102   A jar contains 5 black balls and 5 white
            balls. What are the odds against picking
            out a black ball given that the number of
            favourable outcomes is 5 and the total
            number of outcomes is 10?   1/1

A017103   A jar contains 6 black balls and 8 white
            balls. What are the odds in favour of
            picking out a white ball given that the
            number of favourable outcomes is 8 and the
            total number of outcomes is 14?   4/3

MODEL: A piece of fruit is drawn from a basket containing
           x pears and y peaches. What are the odds [type]
           drawing a [name] given that the number of favourable
           outcomes is n and the total number of outcomes is
           x + y?

                Type ϵ {in favour of, against}
                Name ϵ {pear, peach}
                n ϵ {x,y} $2 \leq x,y \leq 6$

OBJECTIVE A017100 (cont'd)

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Mathematics for the Intermediate Division

TOPIC A017000: Determining Odds

EXAMPLES:

A017104　A piece of fruit is drawn from a basket containing 4 pears and 2 peaches. What are the odds in favour of drawing a peach given that the number of favourable outcomes is 2 and the total number of outcomes is 2 + 4?　　1/2

A017105　A piece of fruit is drawn from a basket containing 6 pears and 2 peaches. What are the odds against drawing a pear given that the number of favourable outcomes is 2 and the total number of outcomes is 2 + 6?　　1/3

A017106　A piece of fruit is drawn from a basket containing 5 pears and 5 peaches. What are the odds in favour of drawing a pear given that the number of favourable outcomes is 5, and the total number of outcomes is 5 + 5?　　1/1

MODEL:　A set of cards consists of x black cards and x red cards. What are the odds [type] drawing a [name] card given that the number of favourable outcomes is x and the total number of outcomes is 2x?

Type $\in$ {in favour of, against}
Name $\in$ {black, red}
$2 \leq x \leq 10$

OBJECTIVE A017100 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A017000: Determining Odds

EXAMPLES:

A017107   A set of cards consists of 6 black cards
           and 6 red cards. What are the odds again
           drawing a black card given that the numbe
           of favourable outcomes is 6 and the total
           number of outcomes is 2 x 6?   1/1

A017108   A set of cards consists of 8 black card
           and 8 red cards. What are the odds in
           favour of drawing a black card given that
           the number of favourable outcomes is 8 an
           the total number of outcomes is 2 x 8?
           1/1

A017109   A set of cards consists of 3 black cards
           and 3 red cards. What are the odds again
           drawing a red card given that the number
           of favourable outcomes is 3 and the total
           number of outcomes is 2 x 3?   1/1

Mathematics for the Intermediate Division

TOPIC A017000: Determining Odds

OBJECTIVE A017200: Finding odds in various situations

MODEL: If you toss x coins, what are the odds [type]
            tossing at least y head(s)?

            Type ε {in favour of, against}

            $2 \leq x, y \leq 4$ $x \geq y$

EXAMPLES:

        A017201   If you toss 2 coins, what are the odds
                   against tossing at least 1 head? 1/3
        A017202   If you toss 3 coins, what are the odds in
                   favour of tossing at least 2 heads?
                   1/1
        A017203   If you toss 3 coins, what are the odds
                   against tossing at least 1 head? 1/7

MODEL: If you toss x coins, what are the odds [type]
            tossing at least y tail(s)?

            Type ε {in favour of, against}

            $2 \leq x, y \leq 4$ $x \geq y$

OBJECTIVE A017200 (cont'd)

Mathematics for the Intermediate Division

TOPIC A017000: Determining Odds

EXAMPLES:

A017204   If you toss 2 coins, what are the odds in favour of tossing at least 1 tail? 3/1

A017205   If you toss 2 coins, what are the odds against tossing at least 2 tails? 3/1

A017206   If you toss 3 coins, what are the odds against tossing at least 2 tails? 1/1

MODEL: If a pair of dice are rolled, what are the odds [type] rolling x and y?

Type ϵ {in favour of, against}

$1 \leq x,y \leq 6$

EXAMPLES:

A017207   If a pair of dice are rolled, what are the odds against rolling 6 and 6? 35/1

A017208   If a pair of dice are rolled, what are the odds in favour of rolling 3 and 4? 1/17

A017209   If a pair of dice are rolled, what are the odds against rolling 2 and 5? 17/1

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A018000: Classifying Events

(a) Reference(s) to the Curriculum Guidelines:
     Grade 7
     Grade 8
     Grade 9
     Grade 10 Adv   A 4b
              Mod   N 9f (Course C)

(b) Difficulty Level:
     pre-instruction = .62, post-instruction = .92

OBJECTIVE A018100:   Classifying events as dependent or
                     independent

MODEL: EVENT 1:   A ball is drawn from a bowl with x black
                     balls and y white balls. It is then
                     put back in the bowl

       EVENT 2:   Another ball is drawn from the bowl.
                     Are these events dependent or independent?

$$5 \le x, y \le 10$$

OBJECTIVE A018100 (cont'd)

Mathematics for the Intermediate Division

TOPIC A018000: Classifying Events

EXAMPLES:

A018101: EVENT 1: A ball is drawn from a bowl with 5 black balls and 9 white balls. It is then put back in the bowl

EVENT 2: Another ball is drawn from the bowl. Are these events dependent or independent?

Independent

A018102: EVENT 1: A ball is drawn from a bowl with 7 black balls and 7 white balls. It is then put back in the bowl.

EVENT 2: Another ball is drawn from the bowl. Are these events dependent or independent?

Independent

A018103: EVENT 1: A ball is drawn from a bowl with 10 black balls and 5 white balls. It is then put back in the bowl.

EVENT 2: Another ball is drawn from the bowl. Are these events dependent or independent?

Independent

OBJECTIVE A01800 (cont'd)

Mathematics for the Intermediate Division

TOPIC A018000: Classifying Events

MODEL: EVENT 1:   A jelly bean is drawn from a jar con-
                    taining x pink jelly beans and y green
                    jelly beans. It is not replaced
                    (set aside)

     EVENT 2:   Another jelly bean is then drawn. Are
                    these events dependent or independent?

$$5 \leq x,y \leq 20$$

OBJECTIVE A018100 (cont'd)

Mathematics for the Intermediate Division

TOPIC A018000: Classifying Events

EXAMPLES:

> A018104 EVENT 1: A jelly bean is drawn from a jar containing 10 pink jelly beans and 11 green jelly beans. It is not replaced (set aside)
>
> EVENT 2: Another jelly bean is then drawn. Are these events dependent or independent?
>
> Dependent
>
> A018105 EVENT 1: A jelly bean is drawn from a jar containing 13 pink jelly beans and 19 green jelly beans. It is not replaced (set aside)
>
> EVENT 2: Another jelly bean is then drawn. Are these events dependent or independent?
>
> Dependent
>
> A018106 EVENT 1: A jelly bean is drawn from a jar containing 10 pink jelly beans and 10 green jelly beans. It is not replaced (setaside)
>
> EVENT 2: Another jelly bean is then drawn. Are these events dependent or independent?
>
> Dependent

OBJECTIVE A018100 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A018000: Classifying Events

MODEL: EVENT 1:   A card is drawn from a deck and then
                   [Action]

       EVENT 2:   Another card is drawn from the deck.
                   Are these events dependent or
                   independent?
                        Action ∈ {replaced, not replaced,
                           held}

EXAMPLES:

       A018107 EVENT 1:   A card is drawn from a deck
                           and then replaced

               EVENT 2:   Another card is drawn from
                           the deck. Are these events
                           dependent or independent?
                           Independent

       A018108 EVENT 1:   A card is drawn from a deck
                           and then not replaced

               EVENT 2:   Another card is drawn from the
                           deck. Are these events
                           dependent or independent?
                           Dependent

       A018109 EVENT 1:   A card is drawn from a deck and
                           then held

               EVENT 2:   Another card is drawn from the
                           deck. Are these events
                           dependent or independent?
                           Dependent

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A019000: Using the Multiplication Law

(a) Reference(s) to the Curriculum Guideline:
     Grade 7
     Grade 8
     Grade 9
     Grade 10 Adv   A 4b
              Mod   N 9e (Course C)

(b) Difficulty Level:
     pre-instruction = .48, post-instruction = .77

OBJECTIVE A019100:   Calculating probabilities of independent
                     events

MODEL: A jar contains 2 green beans, 3 white beans, and
           4 pink beans. A bean is picked from the jar
           and then replaced, and again a bean is picked.
           What is the probability that the first bean will
           be [name] and the second will be [name]?

                   Name ε{green, white, pink}

OBJECTIVE A019100 (cont'd)

Mathematics for the Intermediate Division

TOPIC A019000: Using the Multiplication Law

EXAMPLES:

A019101: A jar contains 2 green beans, 3 white beans, and 4 pink beans. A bean is picked from the jar and then replaced, and again a bean is picked. What is the probability that the first bean will be green and the second will be pink?

8/81

A019102 A jar contains 2 green beans, 3 white beans, and 4 pink beans. A bean is picked from the jar and then replaced, and again a bean is picked. What is the probability that the first bean will be green and the second will be white? 2/27

A019103 A jar contains 2 green beans, 3 white beans, and 4 pink beans. A bean is picked from the jar and then replaced, and again a bean is picked. What is the probability that the first bean will be pink and the second will be pink ? 16/81

MODEL: A card is drawn from a standard 52-card deck. It is then replaced and another card is drawn. What is the probability that the first card will be a [name] and the second a [name] given that there are 13 of each suit in the deck?

Name ϵ {heart, diamond, club, spade}

OBJECTIVE A019100 (cont'd)

Mathematics for the Intermediate Division

TOPIC A019000: Using the Multiplication Law

EXAMPLES:

A019104   A card is drawn from a standard 52-card deck. It is then replaced and another card is drawn. What is the probability that the first card will be a heart and the second a diamond given that there are 13 of each suit in the deck?   1/16

A019105   A card is drawn from a standard 52-card deck. It is then replaced and another card is drawn. What is the probability that the first card will be a club and the second a spade given that there are 13 of each suit in the deck?   1/16

A019106   A card is drawn from a standard 52-card deck. It is then replaced and another card is drawn. What is the probability that the first card will be a club and the second a club given that there are 13 of each suit in the deck? 1/16

MODEL: A piggy bank contains 3 pennies, 2 dimes, and 1 quarter. A coin is shaken from the bank and replaced. A second coin is shaken out. What is the probability that both coins are [name]?

Name ϵ\{pennies, dimes, quarters\}

OBJECTIVE A019100 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A019000: Using the Multiplication Law

EXAMPLES:

A019107   A piggy bank contains 3 pennies, 2 dimes, and 1 quarter. A coin is shaken from the bank and replaced. A second coin is shaken out. What is the probability that both coins are quarters?   1/36

A019108   A piggy bank contains 3 pennies, 2 dimes, and 1 quarter. A coin is shaken from the bank and replaced. A second coin is shaken out. What is the probability that both coins are dimes?   1/9

A019109   A piggy bank contains 3 pennies, 2 dimes, and 1 quarter. A coin is shaken from the bank and replaced. A second coin is shaken out. What is the probability that both coins are pennies? 1/4

OBJECTIVE A019200: Calculating probabilities of independent and dependent events

MODEL: Two cards are drawn at the same time from a standard 52-card deck. What is the probability that one card will be a [name] and the other a [name]?

Name ϵ {heart, spade, club, diamond}

OBJECTIVE A019200 (cont'd)

Mathematics for the Intermediate Division

TOPIC A019000: Using the Multiplication Law

EXAMPLES:

A019201   Two cards are drawn at the same time from a standard 52-card deck. What is the probability that one card will be a heart and the other a heart?   1/17

A019202   Two cards are drawn at the same time from a standard 52-card deck. What is the probability that one card will be a heart and the other a club?   13/204

A019203   Two cards are drawn at the same time from a standard 52-card deck. What is the probability that one card will be a spade and the other a spade?   1/17

MODEL: What is the probability of throwing a pair of dice and getting less than x on both of them?

$$2 \leq x \leq 5$$

EXAMPLES:

A019204   What is the probability of throwing a pair of dice and getting less than 3 on both of them? 1/9

A019205   What is the probability of throwing a pair of dice and getting less than 4 on both of them?   1/4

A019206   What is the probability of throwing a pair of dice and getting less than 6 on both of them?   25/36

OBJECTIVE A019200 (cont'd)

Ontario Assessment Instrument Pool

Mathematics for the Intermediate Division

TOPIC A019000: Using the Multiplication Law

MODEL: What is the probability of drawing 2 [name] balls
          from a jar containing 2 black, 3 white, and 4
          yellow. If you first draw one ball, and then
          another after replacing the first?
                    Name ∈ {black, white, yellow}

EXAMPLES:

          A019207   What is the probability of drawing
                    2 black balls from a jar containing
                    2 black, 3 white, and 4 yellow, if
                    you first draw one ball, and then an-
                    other after replacing the first?   4/81

          A019208   What is the probability of drawing 2
                    white balls from a jar containing 2 black,
                    3 white, and 4 yellow, if you first draw
                    one ball, and then another after replac-
                    ing the first?   1/9

          A019209   What is the probability of drawing 2
                    yellow balls from a jar containing 2
                    black, 3 white, and 4 yellow, if you
                    first draw one ball, and then another
                    after replacing the first?   16/81